UNIVERSITY OF ALBERTA

OUTCOME FOLLOWING HIP FRACTURE

BY

MARILYN WANDA CREE ©

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Doctor of Philosophy

in

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ABSTRACT

The purpose of this study was to identify determinants of outcome following hip fracture in those over the age of 64 years. This study was a population-based prospective cohort study extending over a 13.5 month period, from July 10, 1996 through August 31, 1997. All information was obtained directly from patients if they were English-speaking and had adequate cognitive status, or from next of kin/caregivers (proxies) otherwise. The first (baseline) interview occurred during the first week following the hip fracture, with the follow-up interview being conducted three months post-fracture. Patients were excluded if they resided in an area that was a long distance telephone call from Edmonton, had fractured the same hip within the previous five years, or if their hip fracture could be attributed to some pathological condition. Of the 610 eligible patients, 470 (77%) completed a baseline interview.

The poor outcomes examined included mortality, institutionalization, and lowered health perception. Forty-four (8%) respondents died within three months of their hip fracture. Fifty-eight patients (17%) living in the community before the fracture were living in institutions three months after the fracture. The proportion of respondents rating their health as fair or poor increased from 30% (pre-fracture) to 38% (post-fracture).

The determinants examined included demographic characteristics (age, gender, education and occupational prestige), mental status, number of comorbid conditions, physical function, and social support. Using logistic regression, low mental status was found to increase the chances of mortality and institutionalization. Male gender was found to increase mortality risk four-fold, while each additional ten years of age increased the risk of institutionalization approximately 2.5 times. Multiple linear regression analysis and LISREL were employed to identify predictors of health perception following a hip fracture. Among patients with low mental status, cognitive function had the most influence on health perception. Among the respondents with high mental functioning, physical health (age, number of comorbid conditions, and function) had the greatest impact on health perception.

While this study examined a wide range of possible determinants, the findings indicated that there were other important determinants still to be identified. Further research is suggested to identify these determinants.

To Doug, Meghan, Garett

and my mother, Wanda Cree

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ABBREVIATIONS

ADL	Activities of daily living
AGFI	Adjusted Goodness of fit index
GFI	Goodness of fit index
LISREL	Linear structural relations
LN	Natural log
MMSE	Mini-mental state exam
OR	Odds ratio
POST	Post-fracture
PRE	Pre-fracture
RR	Relative Risk
SF-12	MOS 12-item short form health survey
VIF	Variance inflation factor

CHAPTER 1

INTRODUCTION

STATEMENT OF PURPOSE AND SIGNIFICANCE

1.0 INTRODUCTION

1.1 STATEMENT OF THE PROBLEM

It is known that the incidence of hip fracture increases with age; more than two thirds (70%-80%) of hip fractures affect adults over the age of sixty (Mossey et al, 1989). There is mounting evidence that the increase in hip fractures also may be from a change in aetiology of the injury and not just related to demographic factors (Boyce et al.).

In England, between 1956 and 1983, after adjusting for the increasing age of the population, it was found that hip fracture rates had doubled for both sexes and for all age groups (Boyce et al.). In Finland, age-adjusted incidence rates of hip fracture increased 51% in older women and 80% in older men, between 1970 and 1991 (Parkkari, Kannus et al). This trend has been observed worldwide since the 1930's and, while rates among elderly males continue to soar, rates have begun to plateau or decrease among some female populations (particularly for intracapsular fractures). According to Yankauer, the incidence of hip fracture in women over the age of 80 exceeds 2% per additional year of age, and fewer than one quarter of hip fracture patients (age 65 and over) return to their pre-fracture level of function.

In the United States, there are over 200,000 hip fractures annually, costing over seven billion dollars (Lewinnek et al.). One American study (Gallagher et al) found that by age 90, 32% of women and 17% of men had suffered a hip fracture. In North America and in other developed countries, as life expectancy increases, the average age of those suffering a hip fracture also is increasing, making recovery and rehabilitation an even greater challenge.

Between 1970 and 1991, in Finland, the average age of male hip fracture patients increased from 53 to 69 years, while females were an average of seven years older (from 72 to 79 years) (Parkkari, Kanus et al). The expected number of hip fractures will approach 6.3 million per year worldwide by the year 2050 (Cooper et al). Hip fracture has been found to be particularly disabling in seniors with concurrent diseases such as cardiovascular disease, osteoporosis, or atherosclerosis (Verbrugge).

1.2 STATEMENT OF THE PURPOSE

Studies looking at outcomes after hip fracture have been conducted previously, mostly in Scandinavian countries and Britain. More recently, there has been some research done in this area in the United States. The incidence of hip fracture is highest in the Scandinavian countries and North America (Cummings, Rubin, Black) (Melton). Most studies have looked at the determinants of mortality, but not at long term care placement after hip fracture. All of the research indicates that there are psychological as well as physical factors involved in death and disability from hip fracture. Multiple and interrelated factors are involved in whether a patient has a positive or negative outcome.

Little research on the outcomes of hip fracture has been done in Canada. In Edmonton, between 1981-1987, there were 2,271 hospitalizations for hip fracture among the elderly (Suarez-Almazor et al.). Recovery time from acute illness or injury increases in elderly people over the age of 80 (Yankauer). With increasing numbers of Albertans at risk of hip fracture as the population ages, it is important to be able to identify those seniors at high risk of mortality or placement in long term care facilities at the time of hip fracture.

The purpose of this study is to identify those seniors at risk of mortality or at risk of placement into long term care at the time of hip fracture so that rapid decisions can be made to minimize these risks.

1.3 RESEARCH OBJECTIVES

The two objectives of this study were:

1. Identification of the determinants of mortality and morbidity after hip fracture in the elderly (65 years of age and older).
2. Development of a statistical model to identify those elderly hip fracture patients at high risk of death or long term care placement after hip fracture.

1.4 SIGNIFICANCE OF THE STUDY

According to a provincial publication, "Older Albertans1992", in the next twenty-five years, it is estimated that the number of Albertans 65 years of age and over will almost triple, from 230,550 (1991) to 637,700 (2021). In 1991, 9.1% of Alberta's population was over the age of 64, but by the year 2021, this is expected to almost double to 16.5%. Those over the age of 85 also will increase. In 1991, this group made up 9% of the senior population. By 2011, this group is expected to be 13.2% of the senior population.

With the aging of Alberta's population and the trend in Alberta toward early hospital discharge and community centred care, hip fracture can be a significant cause of expensive home care services, and can result in increased pressure on family and/or friends of the patient. It also can result in a serious limitation in mobility for the older person.

In Sweden and England, rehabilitation programs have been developed to supplement the early discharge program, and to cope with the increasing numbers of elderly (Yankauer). A comprehensive program to deal with hip fracture potentially could decrease costs to the health care system, as well as save lives and increase the quality of life for hip fracture survivors. This comprehensive program should include preventive strategies to decrease the incidence of hip fracture, and special rehabilitation programs for those recovering from hip fracture. These rehabilitation programs must be tailored to the needs of patients. The ability to identify the patient at increased risk of death or serious disability is of particular concern.

1.5 SUMMARY

The causes of hip fracture and the determinants of outcome are multifactorial. With the trend in the developed world towards population aging and a projected increase of 25% in the proportion of those over the age of 75, there will be increasing numbers of the population at risk of hip fracture. There also is some evidence that part of the increase in incidence of hip fracture is independent of age. It is important that hip fracture be prevented whenever possible.

For those experiencing a hip fracture, however, the chances of recovery can be maximized if programs are in place to offer them the medical care, rehabilitation, and social support they need. It is particularly important, in terms of health care dollars and quality of life, that patients be returned to their own homes whenever possible, instead of being institutionalized or hospitalized. Therefore, work must be done to identify those factors that indicate patients at high risk of placement into long term institutional care so that they can be given the help they need to increase their chances of recovery. There has been substantial research in the area of determinants of mortality following hip fracture, but more research is needed to identify the determinants of placement into long term institutional care.

CHAPTER 2

REVIEW OF THE LITERATURE

OUTCOME FOLLOWING HIP FRACTURE

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

The term hip fracture is a generic term referring to a number of different types of fracture of the femur. "The most correct general term is 'proximal femoral fracture', which refers to any fracture of the femur from the femoral head to a level 5 cm below the lesser trochanter. 'Hip fracture' is synonymous and is a more frequently used general term. The primary classification of hip fractures divides those within the capsule of the hip joint (intracapsular) from those outside it (extracapsular)" (Parker and Pryor). The difference in prognosis between intracapsular and extracapsular fractures was first made by Astley Cooper in 1823. While extracapsular fractures tended to heal well, prognosis was poor for intracapsular fractures. He also felt that early mobility was essential, as immobility generally lead to death.

2.1.1 Biology of a Hip Fracture

The femur is the strongest and longest bone in the body. The femoral head is almost spherical in shape and fits into the capsule (acetabulum). This forms the hip joint. The femoral neck extends from the head to the shaft of the femur and most of it is inside the capsule. The femoral neck joins the shaft at the trochanteric region (consisting of the greater trochanter and the lesser trochanter).

In general, intracapsular fractures encompass any fracture of the femoral neck inside the capsule, extending up to the subcapital region (where the neck connects to the head). Intracapsular fractures can be divided into displaced and undisplaced fractures. (See figure 1). The chances of this type of fracture being displaced increase with age (Sernbo, 1988) resulting in displaced intracapsular fractures being more common today than 50 years ago (Sernbo,Johnell). The neck of the femur has a normally poor blood supply, and this may contribute to the poor healing of these types of fractures, especially the displaced ones.

Extracapsular fractures are much more varied than intracapsular fractures. There are three broad regions where these fractures can occur. (See figure 2).

- **basal** fractures occur at the point where the neck joins the shaft, at the trochanteric region. These fractures can be displaced or undisplaced.
- **trochanteric** fractures are a group of fractures that can occur at the trochanteric region and can extend down into the subtrochanteric region (the part of the shaft that extends 5 cm below the trochanteric region). These fractures can be displaced or undisplaced. In addition, displaced fractures can be further broken down into two-part, three-part, or four-part (depending on the number of fragments of bone resulting from the fracture), and reversed fracture line (a rare type of trochanteric fracture, estimated to be approximately 8% of all trochanteric fractures, where the line of the fracture is reversed from the usual line).
- **subtrochanteric** fractures are any of a group of fractures occurring in the subtrochanteric region. They can vary by type and direction of fracture line and by the amount of bone shattering involved.

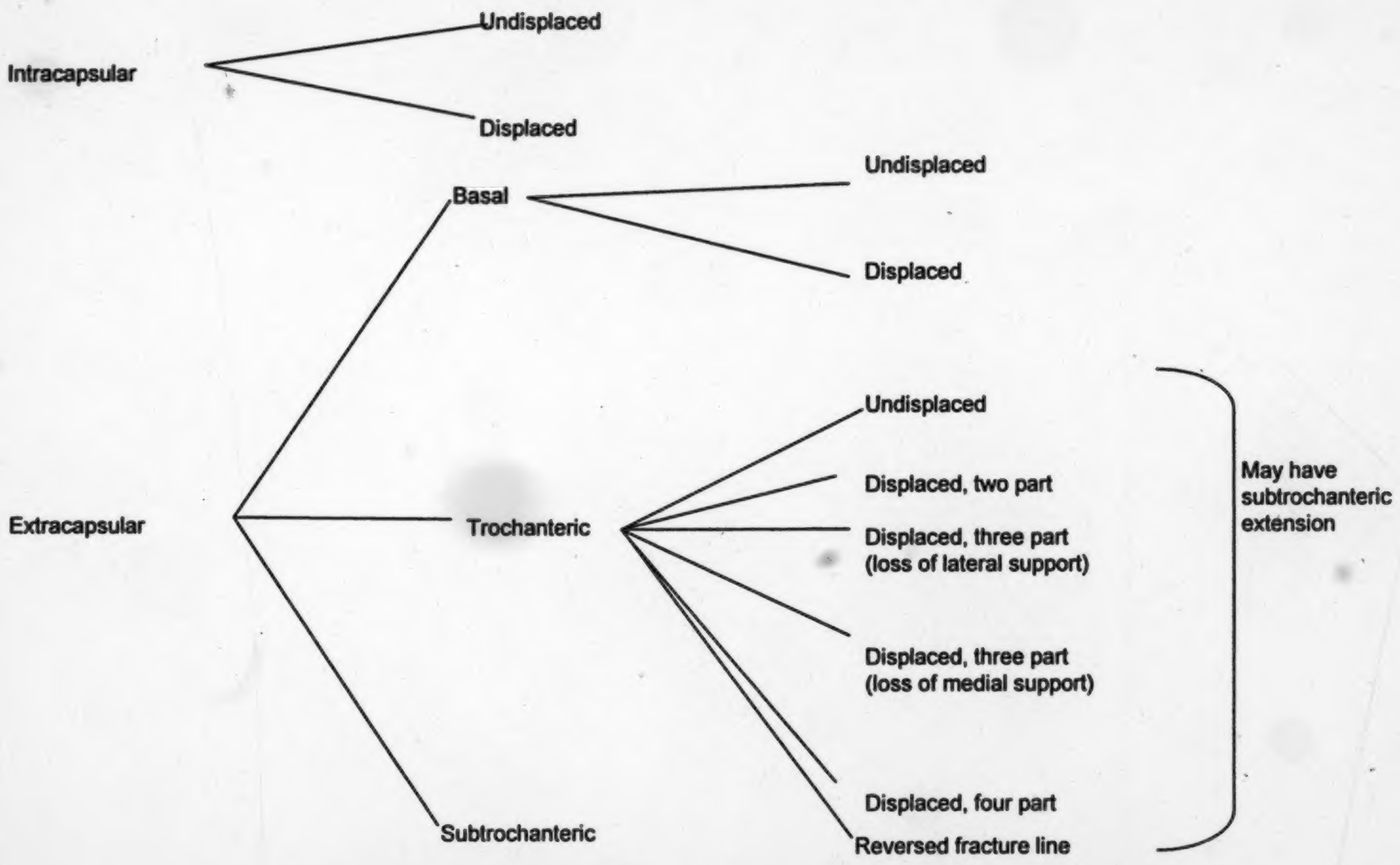
Intracapsular
Undisplaced
Displaced
Extracapsular
Basal
Undisplaced
Displaced
Trochanteric
Undisplaced
Displaced, two part
Displaced, three part (loss of lateral support)
Displaced, three part (loss of medial support)
Displaced, four part
Reversed fracture line
May have subtrochanteric extension
Subtrochanteric

FIGURE 1 RECOMMENDED CLASSIFICATION SYSTEM OF HIP FRACTURES

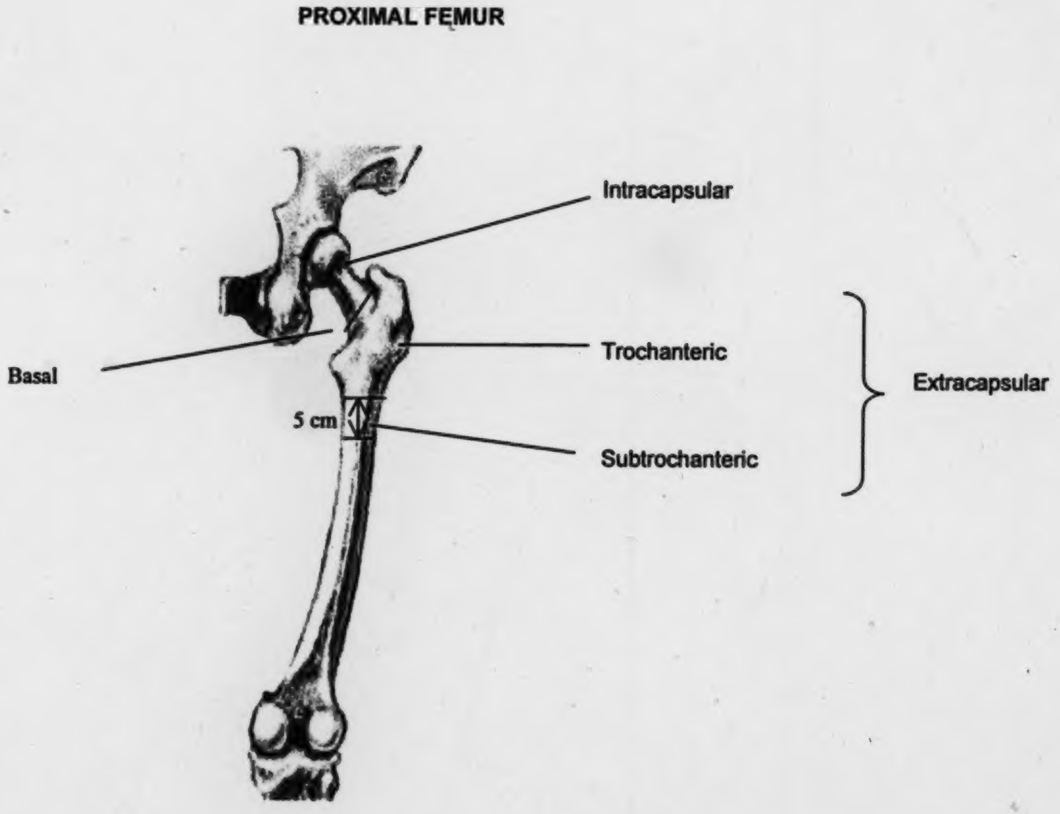
PROXIMAL FEMUR
Intracapsular
Basal
Trochanteric
Extracapsular
5 cm
Subtrochanteric

FIGURE 2 RECOMMENDED PRIMARY CLASSIFICATION OF PROXIMAL FEMORAL FRACTURES

2.1.2 The Healing Process

As the broken ends of the bone are joined together by newly synthesized bone, the fracture heals. The following conditions can interfere with the healing of fractures:

- Infection which may cause inflammation, leading to reduced blood flow (ischaemia) or tissue damage (necrosis);
- Fat embolism , where fat originating in the medullary canal blocks veins, frequently in the lungs;
- Tissue fragments between the ends of bone have not been removed, interfering with the formation of new bone;
- Deficient blood supply can delay the formation of scar tissue and blood vessels. The resulting lack of oxygen (hypoxia) leads to fewer osteoblasts and more cartilage-forming cells (chondroblasts) developing so that cartilage may join the bones together instead of bone;
- Formation of new bone is disrupted owing to continual movement of the ends of the bone. This results in the scar tissue uniting the ends of the bone becoming fibrous;
- Old age results in slower healing of bones.

2.2 CAUSES OF HIP FRACTURE

There is evidence to indicate (Mautalen et al) that different mechanisms are involved in extracapsular (trochanteric) and intracapsular (femoral neck or cervical) fractures. Trochanteric fractures are the result of poor bone quality (particularly trabecular bone). This problem becomes more serious with age. The structure of the pelvis may influence the risk of cervical fractures. It is known that there is a genetic predisposition to these types of fractures and they are more likely to occur in those who are taller.

Usually a hip fracture occurs in an elderly patient (often female) as the result of a fall or twist. Estimates indicate that in 93.7% of cases, the fall precedes the hip fracture, but the fracture can precede the fall (from osteoporosis) (Mehta and Nastasi). The causes of hip fracture are multifactorial, and can be broadly grouped into four categories:

- risk of falling;
- protective responses to falls;
- bone strength;
- genetic factors.

A hip fracture can be caused by one of these factors alone, or some combination of them. These factors will be discussed in more detail later during the discussion on risk factors and factors influencing outcomes of hip fracture.

2.3 SYMPTOMS

The symptoms of hip fracture include the following (Parker and Pryor):

- Pain. The amount and location of pain varies with the type of fracture (generally extracapsular fractures are more painful than intracapsular ones);
- Tenderness. Occurs in the hip area;
- Bruising. Occurs with extracapsular fractures;
- Leg attitude. Normal for an undisplaced fracture, but can have an external rotation when displaced;
- Standing. The patient is unable to bear weight;
- Swelling. Occurs in the surrounding tissues;
- Leg shortening. Can occur in displaced fractures.

2.4 ASSESSMENT

A plain radiograph or a bone scan (for pathologic or stress fracture) is useful in yielding a diagnosis of hip fracture. In addition to diagnosing the hip fracture, it is important to take a detailed clinical history from the patient in order to gather information on past and current illnesses and medications taken. It is important to determine the cause of the fracture. Often these patients will not have been in optimal health before the fracture.

Parker and Pryor feel the following areas should also be assessed:

Mobility: If the patient's mobility was good before the fracture, chances of recovery are better. Judging mobility involves the patient's ability to:

- Move in bed;
- Transfer to and from bed, chair, commode, bathtub, car;
- Stand;
- Walk: on level surface, inclined surface, up and down stairs, up and down curbs, and change directions.

Activities of Daily Living (ADL) : This assesses a patient's functional status and independence and provides a goal to work toward during rehabilitation. The five activities of daily living usually assessed include bathing, dressing, moving (from bed to chair), toileting, and eating.

Mental Assessment: Cognitive status is strongly correlated with death following hip fracture. There are several tests to assess mental status, such as Folstein's mini mental state exam (Folstein).

Social Network : A strong social network is very important to the patient's recovery, and to remaining in the community after discharge from hospital. It also gives insight into how the patient was functioning before the hip fracture. One study (Ceder, Lindberg et al.) found that two thirds of patients admitted to hospital for hip fracture came from their own homes, and the remaining one third came from institutions. Some patients admitted from their own homes already may have been dependent on family and friends in coping with daily living and will have increased concern about how they will cope after their hip fracture.

Laboratory Indices: Low haemoglobin, low lymphocyte count, low serum albumin and high blood calcium phosphate product all correlate with increased death.

Assessment of the Amount of Osteoporosis: There are various methods to measure bone density, and a higher degree of osteoporosis is related to increased fracture instability and more complications from fixation.

Admission to hospital is the best time to start planning for a patient's discharge. Collecting the above information will facilitate this planning and also clarify for family and friends what to expect in terms of recovery. If a person has fallen, was admitted from home, and expects to be discharged back home, an environmental assessment will have to be done to make the home safe.

2.5 TREATMENT FOR HIP FRACTURE

There is a vast amount of literature on the best surgical approach to apply for different fracture types, and suiting the method to the patient. The goal, however, is to promote healing of the fracture by inducing stability and seeking impaction while at the same time minimizing the chances of mortality or morbidity.

2.5.1 Intracapsular Fractures

Sometimes called the "unresolved orthopedic fracture" (Obrant), internal fixation is often unsuccessful in intracapsular fractures, particularly the displaced ones. There is a high rate of nonunion and avascular necrosis owing to the lack of periosteum and poor blood supply to this area.

Ochs (1990) indicates that there are four surgical procedures that can be applied to these fractures:

- Knowles pinning involves using multiple pins to join the trochanteric and femoral neck and head together. The advantages of this method are that it is quick and only local anesthetic is required. Unfortunately, weight bearing may be delayed for up to three months following this procedure and penetration of the femoral head occurs frequently.
- The Jewett nail is a device driven through the femoral neck and head and attached to the shaft with screws. The advantage of this procedure is that it allows for immediate postoperative weight bearing.
- The most commonly used device is the sliding nail or compression screw. Unlike the previous two devices, the sliding nail or compression screw can be tightened, bringing the fractured bone together (compression).
- Hemiarthroplasty or total hip replacement is usually used for displaced femoral neck fractures because of the high failure rate for fixation procedures. In hemiarthroplasty, (such as the Austin-Moore prosthesis), the femoral neck and head are replaced. Full weight-bearing immediately after surgery is possible; however, up to 15% of cases suffer dislocation. The acetabulum also will deteriorate over time, leaving total hip replacement as the alternative of choice for younger, more active patients. Total hip replacement has the disadvantage of having higher perioperative complications and eventual loosening of parts. It also is more costly and has a longer operating time. For these reasons, the choice of operative strategy often is not clear and varies widely among surgeons. One study showed that while 94% of displaced intracapsular fractures were treated with arthroplasties in Holland, internal fixation was used in virtually all of these fractures in Sweden (Berglund-Roden et al). Over Ontario counties, arthroplasty usage rate for treatment of intracapsular fracture ranged from 9% to 83% (Jaglal et al).

2.5.2 Trochanteric Fractures

The goal should be to achieve or maintain stability of the fracture (by ensuring impaction), and mobility for the patient as soon as possible. These fractures tend to be more fragmented and osteoporotic than fractures of the femoral neck and are therefore more unstable. Procedures of fixation are similar to those stated above, with the most common method being the sliding nail or compression screw (Ochs). Success rates are high, similar to those of other fractures, the only disadvantage being a shortening of the leg that occurs in some patients.

2.5.3 Subtrochanteric Fractures

Meyers recommends reduction and internal fixation for subtrochanteric fractures. Because only 3% of hip fractures occur in this region, the treatment of this type of fracture has received less attention than the treatment of the trochanteric or intracapsular fractures.

2.6 POSTSURGICAL TREATMENT AND COMPLICATIONS

Mortality is reduced if surgery occurs within 24 hours of admission (Davis et al.). There is some evidence that the sooner surgery is done, the better the outcome, whenever a fracture of the femoral neck has occurred. Surgery is preferable within 12 hours of admission (please see Section 2.10.3) (Bredahl et al.). Before surgery, the patient can be mentally prepared, and it is very important that the patient is hydrated. Generally, upon admission for hip fracture, many patients are suffering from some degree of dehydration. This may be because they were dehydrated before the fracture or this may have occurred between the time the fracture occurred and the time they were admitted to hospital (Parker and Pryor).

As a result of the trauma from the injury, the elderly patient may experience physiological and mental reactions that would be different from those of a younger person:

- Cardiovascular system. With aging, the heart becomes less efficient and therefore the cardiac output decreases. Trauma alters the vascular requirements, and in combination with other conditions such as high blood pressure, existing cardiovascular conditions may worsen.
- Metabolism. In response to injury, metabolism increases, and this may cause fever which may result in hypothermia because thermoregulation is less efficient in the elderly. Hypothermia may result in a catabolic state causing a significant breakdown of muscle.
- Blood sugar levels. Glucose metabolism in the elderly is less efficient and many elderly are diabetic. In reaction to trauma, hyperglycemia tends to occur and this can lead to glycosuria in ketosis (in the diabetic patient).
- Acute confusion. This often occurs as a result of injury and arises from a combination of factors (the fracture, the hospital environment, drugs). Parker and Pryor feel this should be considered the result of an illness and not, as commonly happens, dementia. After controlling for risk factors such as age and activity level, Williams et al. found that interventions that provided orientation and clarification, corrected sensory deficit, and increased continuity of care, significantly reduced the incidence of acute confusional state from 51.5% to 43.9% in the group of patients in their study.

Within the first 24 hours, Parker and Pryor suggest that the elderly patient receives special attention in the following areas:

- Adequate oxygenation. Oxygen delivery to the tissues is particularly reduced during this period, particularly in the presence of hypothermia or formation of a fat embolism.
- Analgesia. This must be carefully monitored because the metabolism of

drugs of any kind are different in the elderly, primarily from reduction in function of the kidneys and liver.

- Fluid Replacement. Dehydration can lead to mental confusion while overhydration can lead to cardiac failure.
- Blood transfusion. This is necessary in some cases from anemia caused by bleeding. Extracapsular fractures usually result in more blood loss than intracapsular fractures. Parker and Pryor found that blood transfusions were required in approximately half the patients with trochanteric fractures, and also in the same proportion of patients undergoing hemiarthroplasty.
- Bladder control. Catheterization is sometimes necessary, and bladder infections from catheterization are a common complication after fracture of the hip (Parker and Pryor).

2.6.1 Treatment

During the week following surgery, good nutrition is important and mobilization should be encouraged. Hip fracture patients are at high risk for complications. This is because they tend to be elderly, frail, have a number of comorbidities, and a long length of stay in hospital, which will increase the chances of contracting nosocomial infections. Once they experience one complication, their resistance is lowered and they are susceptible to further complications (Parker and Pryor). Complications also increase as the surgery becomes more traumatic. Internal fixation of an intracapsular fracture is less stressful than internal fixation of a trochanteric fracture or arthroplasty. The increased risk of complications is one factor which causes the high mortality rate within the first six months post fracture (Parker and Pryor).

2.6.2 Complications

Common complications after surgery include:

- Respiratory problems. Pneumonia or a collapsed/partially collapsed lung from bronchial obstruction are major problems after surgery. Respiratory problems are the most frequent cause of death in patients with hip fracture, and respiratory therapy along with early mobilization are important to counteract these problems (Parker and Pryor).

- Thromboembolic problems. One study found the incidence to be approximately 4% (Larsson et al.).
- Cardiovascular problems. Incidence of this has been estimated to be 17 % (Jensen et al.). Myocardial infarction, cardiac failure, and heart arrhythmias are the primary cardiovascular problems. Suman found that the mortality rate among hip fracture patients who suffer a myocardial infarction was about 50%. Heart arrhythmias and previous myocardial infarction are significantly associated with increased mortality.
- Wound infection. This depends on the type of fracture and ranges from 3% (Chan et al.) following hemiarthroplasty, 2% following total hip replacement (Coates et al.), and 2.7% following surgery using sliding-screw technique for trochanteric fractures (Larsson et al.). Surgery involving smaller incisions and shorter operating time (Dolk) are generally related to less wound infection. Posterior surgical approach (Montgomery et al., Chan et al.) and failure to drain the wound (Chan et al.) also were related to more infection.
- Pressure sores. The incidence is estimated at 7% (Jensen et al.).
- Other complications. These occur less frequently and include kidney and liver failure, stroke, intestinal bleeding, and depression (Mossey et al.).

Common complications specific to hip surgery include early fracture redisplacement, failure of the fracture to heal, and avascular necrosis leading to damage of the femoral head. Rates of failure to heal ranged from 10% (Fielding) to 25% (Nilsson et al.) for patients with intracapsular displaced fractures, depending on type of internal fixation used. Some research has shown that proper fracture reduction and stable fixation are necessary to prevent avascular necrosis (Arnoldi et al.). Estimates of incidence of avascular necrosis range from 7% (Frandsen et al.) to 42% (Johnson et al.) in patients with displaced intracapsular fractures which were followed for at least two years, depending on the type of internal fixation used. It may be many years before avascular necrosis becomes clinically evident, but it can be detected radiologically in 80% of patients who develop avascular necrosis after a two year period following fracture.

2.7 REHABILITATION

The importance of rehabilitation in reducing length of hospital stay, mortality and morbidity following hip fracture was first recognized by Astley Cooper in the 1800's. However, it was not until the 1960s in England that rehabilitation programs for the elderly trauma patient were first implemented. The goal of rehabilitation programs is to help the patient return to their pre-fracture functional status, and to maximize the chances of a positive outcome following successful surgery.

During the course of rehabilitation, activities and exercises gradually are increased. Usually the patient starts with breathing, range of motion, and isometric exercises, followed by bed to chair transfers. Introduction of weight-bearing depends on the weight and ability of the patient, type and stability of the fracture, and quality of bone (Mehta and Nastasi).

Researchers have found (Ceder, Lindberg et al.) that of hip fracture patients admitted from their home, 62% of survivors were discharged directly back to their own homes, and that mobility at two weeks after surgery was a good indicator of ability to return to their own homes after discharge. Mean length of hospital stay for these patients was 3-4 weeks.

Parker and Pryor indicate that effective rehabilitation depends on accurate assessment of the mental and physical health of the patient, successful surgery, and rehabilitation programs tailored to the needs of the patient. Whether patients return to their own homes at discharge depend on the degree of functional independence achieved (the best that can be expected is that the patient return to their pre-fracture functional level), and the amount of social and community support available for them. The greater the amount of support the patient has, the earlier they can return to their home.

At present, Parker and Pryor state that the following types of options are open to hip fracture patients after surgery:

- "Traditional" care in hospital until patients appear to be ready to cope with life in their own homes, or they can be institutionalized;
- Patients can be entered into an "orthogeriatric" type of program where care and rehabilitation is supervised by a combination of orthopedic and geriatric specialists;
- Early discharge and rehabilitation in the home and community support provided as needed.

The traditional approach can be an inefficient use of hospital resources. Robbins and Donaldson (1984), studied 216 patients with fracture of the femoral neck. They found that 51% of patients' hospital days were spent recovering from surgery without complications, and a further 28% were awaiting discharge after medical care was complete. Another study was done in the United States to compare outcomes following hip fracture in elderly women discharged to three different posthospital settings : home, inpatient rehabilitation, and skilled nursing. Controlling for patient characteristics, those discharged to a skilled nursing setting were there longer and had more rehabilitation than those discharged to a rehabilitation setting. Outcome, in terms of self-care, was the same for both groups (Levi).

In comparing the traditional care with the orthogeriatric type of program, one study (Gilchrist et al.) found that, of the 97 patients randomized to orthogeriatric care and the 125 to orthopedic wards, length of stay, mortality, and placement did not differ significantly. There were, however, more medical conditions diagnosed and treated in patients in the orthogeriatric care. Five percent of patients from the orthogeriatric care unit, as compared to 30% of patients from the orthopedic ward, were discharged with 'untreated' illness.

The Swedish were the first to implement an early discharge and rehabilitation program for hip fracture patients in the 1970s. This program was applicable to patients admitted from their homes, and it was found that approximately 90% of patients with two of the following three criteria were able to return directly to their home: health, living with someone, and ability to walk two weeks after surgery. Seventy-five percent of patients were ready to return home after two or three weeks in hospital. After four months, almost 82% of surviving patients had returned home, most having achieved their pre-fracture functional status (Ceder, Thorngren et al.).

Since then, similar programs have been implemented in Australia and England. A study of the program in England has found that early discharge combined with home rehabilitation produced significantly fewer bed days and better chances of recovery in patients (Pryor).

Pryor and Parker suggest there are two broad groups of patients, and rehabilitation should be different for each group. For the group of patients admitted from institutions with comorbidities that will interfere with their recovery, hospitalization is the best solution. For those patients functioning independently before fracture, their chances of recovery will be maximized by early discharge that is supplemented with home-care.

2.8 RISK FACTORS FOR HIP FRACTURE

2.8.1 Demographic Factors

Several demographic factors have been associated with elevated risk for hip fracture:

- Age. Hip fracture rate increases with increasing age (Mossey et al.), likely because of the physiological changes that occur in the visual, neurological, musculoskeletal and cardiovascular systems during aging (Parker and Pryor).
- Gender. Two to three times the number of females as males fracture a hip (Schroder et al.). Women tend to fall more frequently. The reason for this is not completely understood. However, research has shown that by controlling for physical and social variables (drug usage, ability to rise from a sitting position, going outside less than daily, and living alone), women still have a slightly increased propensity to fall (Campbell et al.). In combination with this increased risk of falling, women also have lower bone density and bone mass (Melton, 1993).
- Race. Caucasian women are at highest risk of hip fracture, with lifetime hip fracture risk estimated at between 16% to 18% (Cummings,Black,Rubin, 1990). Lau found similar hip fracture rates among Hong Kong Chinese as among Caucasians living in England. However, rates among those of African or Japanese ancestry were approximately half of the Caucasian rate (Farmer et al.,Ross et al.). It also has been found that rates among Hispanic women are lower than among Black women (Silverman et al.). Factors other than degree of osteoporosis are responsible for this (Makin). It has been suggested that one such factor is the difference in structure of the hip among races, with hip axis length and femoral neck width being significantly longer in caucasian, as compared with black, women (Mikhail). Some research also has shown that Caucasian women have a higher risk of falling than black women (Melton, 1993). It is unclear why this should be the case and other research has not corroborated this finding (Tinetti, 1998).

2.8.2 Lifestyle Factors

Several lifestyle factors have been associated with elevated risk of hip fracture:

- Sedentary lifestyle. Inactivity increases chances of hip fracture (Astrom et al.,Coupland et al.). This is thought to be related to loss of bone mass, and to increased risk of falling (which results from weakened muscles).
- Nutrition. Lack of copper (Conlan et al.), vitamin D and calcium (Brown et al, Chapuy et al, Lauritzen et al.), calcitonin (Mazzuoli et al.), and protein (Bonjour) and low body mass (Bastow et al, Cumming et al, Hemenway et al) are related to increased risk of hip fracture. Being underweight is related to increased risk of fracture; possible reasons for this include less fat to protect the hip during a fall, and/or less bone mass in thinner women. While this may also apply to males, there is no research to indicate this.
- Smoking. Smoking increases the chances of hip fracture (Lauritzen et al.,Cumming et al.), with estimates indicating that there could be a 40% decrease in fracture risk for women who quit smoking (Cummings, 1996). Increases in bone loss in both male and postmenopausal female smokers have been observed. While the exact mechanism through which this occurs is unknown, it is thought there may be some direct effect on bone, combined with a higher risk of falling because smokers are generally less healthy than non-smokers (Hackshaw).
- Alcohol. Alcoholism is a risk factor for hip fracture (Lauritzen et al.,Felson et al.,Hemenway et al.) because it tends to lead to malnutrition and increased tendency to fall.
- Geographical. Where a person chooses to live affects fracture risk, with the risk being lower in the rural than in the urban centres (Larsson et al.). Compared to those living in rural centres, their urban counterparts tend to have poorer nutrition (calcium and vitamin D), lower body weight, less exercise, higher consumption of alcohol and drugs, more smoking, more comorbidities, and more pollution. Many of these same life-style factors lead urban-dwellers to exhibit a greater tendency to fall.

2.8.3 Medications

Several medications have been associated with increased/decreased risk of hip fracture:

- Corticosteroids. These medications are a risk factor for fracture (Cooper et al.) because they cause a reduction in bone strength.
- Thyroxine. Hyperthyroidism reduces bone strength, making it a risk factor for hip fracture (Wejda).
- Antihypertensive drugs. One study indicated a protective effect of thiazide diuretic drugs (Lacroix et al.). Thiazide decreases urinary calcium and may inhibit bone resorption.
- Hormone replacement therapy. This therapy had a protective effect among women who had undergone oophorectomy (Paganini-Hill et al.). Estrogen is known to have a protective effect on bone density.

2.8.4 Illnesses

The following illnesses have been found to be related to an increased risk of hip fracture, primarily because they increase the risk of falling:

- Heart arrhythmia (Abdon et al.);
- Mental confusion (Brocklehurst et al.);
- Impaired vision (Brocklehurst et al.,Grisso et al.);
- Rheumatoid arthritis (Cooper et al, Johnell and Sembo);
- Parkinson's Disease (Chiu et al, Christodoulou et al, Grisso et al, Johnell, Melton et al.);
- Diabetes (Johnell and Sembo);
- Stroke (Chiu et al.,Christodoulou et al.,Grisso et al.);
- Previous fracture (Finsen et al.).

2.8.5 Fall Characteristics

Estimates show that there are approximately 30 million falls in the United States each year. Only 1% of these falls results in a hip fracture. There has been some debate as to whether it is the fall or the bone fragility that causes a hip fracture.

By calculating the ratio of the force applied to the hip divided by the force necessary to cause a hip fracture, Hayes et al.(1996) have examined the relative importance of fall severity versus bone mass to hip fracture risk. They conclude that it is some combination of both, and that the relative importance of bone fragility and fall severity varies from person to person.

It has been suggested (Nevitt and Cummings) that the following constitute a high risk fall for hip fracture: 1) impact near the hip; 2) inadequate response to break the fall; and 3) lack of protective padding for the hip. In addition, it has been found that in the year following a hip fracture, decrease in bone mineral density from the femoral neck is five times higher in those who have experienced a fracture as compared to those who have not sustained a fracture (Dirschl). In combination with this loss in bone density, research shows that having one fall puts a person at an increased risk of falling again, making subsequent hip fractures more likely. Some characteristics of a high risk fall include the following:

- Direction of the fall. Among 'elderly fallers', a sideways fall increases hip fracture risk approximately six-fold in community dwelling elderly (Greenspan, Myers, Maitland, et al) and approximately twenty-fold in the elderly in nursing homes (Hayes, Myers, Morris et al.).
- Falls to the side that impact the hip. This increases risk of hip fracture from six- to thirty-fold among community dwelling elderly (Nevitt and Cummings).

2.9 OUTCOMES FOLLOWING HIP FRACTURE

Outcomes following hip fracture can be grouped into three broad categories: mortality, placement in long term care, and recovery.

2.9.1 Mortality

It is difficult to determine the mortality from hip fracture, and there is a wide variation in estimates because of differences (particularly in age and fracture type) of those studied. In addition, there often are a number of concurrent illnesses in a hip fracture patient and, if the patient dies following hip fracture, it is difficult to determine the cause of death. However, many studies have been conducted to estimate mortality and the determinants of mortality following hip fracture.

Parker and Anand found in their study that of 709 patients admitted for fracture, 37% were dead within one year. Hip fracture was considered to be the cause of death for 9% of these patients and possibly related to death for a further 16% of patients. By looking at the cause and time until death, they estimated the mortality from hip fracture to be 15%.

Deaths from hip fracture usually occur in the first six months following the hip fracture, and depending upon the characteristics of the study population (in terms of age, type of fracture, and pre-fracture functional status), mortality rates during this time period range from 13% to 44% (Marottoli et al). Mortality rates up to one year following hip fracture are 12%-20% higher than in similar groups in the general population (Mossey et al).

A study done in Denmark (Schroder et al.) followed 3,895 hip fracture patients for up to18 years. They found that 19% of women and 25% of men died within the first year following fracture, and that mortality among these patients was higher than expected up to ten years following fracture.

One study done in Nova Scotia in 1966-1968 (Gordon) looked at the probability of death following hip fracture in patients 45 years of age and over. This study found that 63.8% of the 202 hip fracture patients included in the study were still alive one year after fracture and that this was 70% of the survival rate expected in the general population. This study, using survival analysis to compare subgroups of the sample, found that males over the age of 74 who were "relatively immobilized" prior to fracture were at highest risk of mortality, with only 38% still surviving one year after fracture.

2.9.2 Institutionalization

The rate of institutionalization following hip fracture has been estimated to be 29% six months following hip fracture (Marottoli et al.). While rates of institutionalization from hip fracture are easier to determine than mortality, this also is highly dependent on the characteristics of those in the study, and the type of fracture. It has been found that of those surviving six months after hip fracture, 60%-70% of the good ambulators before fracture became good ambulators afterwards, but only 20%-30% of poor ambulators pre-fracture ever walked again (McCown et al.). In another study, Jensen, Tondevold and Sorensen found that 17% of surviving patients admitted from their homes were institutionalized six months after fracture. Cumming et al. (1996) found that, after controlling for pre-fracture health status, risk of institutionalization during the following year was five times higher among elderly who had suffered hip fracture compared to those who had not. Another study (Fitzgerald et al.) found that of 189 patients who were in their own homes before fracture, but institutionalized upon discharge, 43% had returned to the community by the end of one year.

As with mortality, most recovery in functional status occurs in the first six months following fracture (Magaziner et al.), and most patients do not return to their pre-fracture functional level.

2.10 DETERMINANTS OF OUTCOMES OF HIP FRACTURE

Weiss et al. conducted a study comparing outcomes of women with hip fracture to women with fracture of the lower forearm. Both groups were aged 50 –74 years. They found that while both groups of women had experienced the trauma of a fracture, mortality was higher in the hip fracture patients. They concluded that it was the hip fracture and its consequences, rather than factors predisposing to fracture that led to higher mortality.

Whether a hip fracture patient recovers or not depends on a complex group of demographic, pre-fracture, and post-fracture variables, many of which are interrelated.

2.10.1 Demographic Factors

Poor outcomes (mortality and institutionalization) were more likely for the following:

- Males (Boereboom et al.,Borgquist, Nordell et Al.,Schroder et al.). While it is not known why mortality among males is higher than females, it has been conjectured that males have more serious falls, more comorbidities, or less social support (Magaziner, Sorock). Further research has shown that even when controlling for comorbidities, mortality among males is higher (Myers et al.).
- Older age groups (Boereboom et al, Broos, Stappaerts et al, Ceder, Svensson et al.). The older a person is, the more difficult it is for them to recover from a trauma such as a hip fracture.
- Single marital status/living alone (Borgquist, Ceder et al, Ceder, Ekelund et al.,Ceder, Thorngren et al.,Crane et al.). In addition to the psychological factors offered by social support (please see social support below), an individual living on his/her own is much more likely to be institutionalized following fracture because of increased functional dependency.

2.10.2 Pre-fracture Factors

Chances of a poor outcome increased with:

- Poor pre-fracture health/functional status (Borgquist, Ceder et al.,Broos, Stappaerts et al.,Broos, Van Haaften et al.,Campion et al.,Ceder, Svensson et al.,Ceder, Thorngren et al.). Poorer health before fracture creates greater difficulties in recovering after hip fracture.
- Few/no social contacts before fracture (Borgquist, Nordell et al.,Ceder, Svensson et al.). Social support is known to be related to mortality (House, Robbins, Metzner) and is important to the psychological well-being and coping ability of an individual (Cicirelli, Troll).
- Being institutionalized pre-fracture (Ceder, Ekelund et al.,Chiu et al.). These individuals often have functional/cognitive impairments before their fracture which impact on their post-fracture recovery.

2.10.3 Post-fracture Factors

These factors can be divided into medical factors and factors relating to the individual patient.

The following medical factors correlated with poor outcome:

- In-hospital complications (Boereboom et al.,Broos, Stappaerts et al.) Please see section 2.6 for further discussion.
- Extracapsular as opposed to intracapsular fracture (Keene et al., Borgquist, Nordell et al.,Ceder, Svensson et al.). Because extracapsular fracture risk increases with increasing age, risk of a poor outcome is expected to be elevated in those with extracapsular fractures.
- Some surgical techniques and internal fixation devices correlated with poor outcome (Chan et al.,Covert et al.,Cole et al.,Coates et al.,Cobelli et al.,Corzatt et al.). Please see section 2.5 for further discussion.
- Longer time between admission and surgery (Bredahl et al.). The longer the time to surgery, the longer the time the patient will be immobilized, leading to

more postoperative complications such as pressure sores, urinary tract infections, and pulmonary complications.

Individual patient variables are also related to poor outcome. These factors include:

- Depression/cognitive impairment (Billig et al.). This affects the patient's motivation and ability for rehabilitation after fracture.
- More concurrent illnesses (Boereboom et al., Campbell,Ceder, Elmqvist et al.). Please see section 2.6.
- Negative expectations for recovery (Borkan et al., Brown and Furstenberg). When patients believe that they are not going to recover, this affects their motivation during rehabilitation and the ensuing months following fracture.
- Delirium/confusion (Magaziner et al., Brannstrom et al.). Delirium is more likely in older patients and patients with more comorbidities, putting an individual at greater risk of poor outcome.
- Inability to walk at time of discharge (Broos, Van Haaften et al., Ceder, Svensson et al., Ceder, Thorngren et al., Chiu et al., Crane et al.).
- Lack of family support after fracture (Broos, Stappaerts et al.). Social support (from family, spouse, and friends) is very important in the recovery of the patient.

2.10.4 Multifactorial Studies

While a lot of research has gone into identifying the determinants of mortality following hip fracture, more research is needed into the determinants of recovery (in terms of regaining independence and returning home). In measuring health and recovery after fracture, subjective (health perception, mental status, social support) and objective measures of function often are used together. One study (Borquist et al.) found for acute conditions such as hip fracture, the objective measure of function was sufficient to assess health following fracture. Other research has found health perception to be important (Jana, Mutran, et al.).

However, while there may be some disagreement over the importance of health perception, there is little doubt that age, gender, pre-fracture physical and mental function, and perhaps some aspect of social support are predictive of recovery.

Jana, Mutran, et al. examined the impact of psychosocial factors, (depression, personality, social connectedness, and health perception) on recovery of physical function following hip fracture among 219 community-dwelling women over the age of 59. They found that poor mental status and post-surgical health perception were related to increased risk of mortality during the twelve months following fracture. Age, pre-fracture mental and physical function, and post-fracture depression were related to recovery in this group of patients.

Another study (Magaziner et al.) examined the relationship between social support, health perception, mental health (dementia and depression) and hospital-related experiences on recovery among 536 community-dwelling hip fracture survivors (at one year). Most recovery was evident by six months in these patients. Recovery was poorer in those who were older, spent more days in hospital, were rehospitalized, and who had poor mental health. Of the three social support areas examined (married, network size, and amount of contact with social network following hospital discharge), only the last was found to effect recovery.

Marottoli, Berkman, and Cooney followed a cohort of 2,806 community-dwelling seniors to assess the impact of pre-fracture mental (dementia and depression) and physical function, social support (network size, marital status, number of emotional or task supports, and number of social activities) and demographic variables (age, gender, race) on functional recovery following hip fracture. Over a six year period, 120 members of this cohort suffered a hip fracture, and pre-fracture function and depression were predictive of recovery among survivors (at six months). Fracture site, number of comorbidities and complications, and mental status were significantly related to mortality, while only mental status was indicative of institutionalization.

Other research supports the importance of social aspects in recovery. One study (Ceder et al.) examined the importance of medical condition, type of fracture, gender, living with someone, shopping before fracture, ability to walk two weeks post-surgery, ability to manage ADL two weeks post-surgery, age, and ability to visit someone before fracture. Among this group of 103 community-dwelling patients over the age of 50, only the last two variables were predictive of whether a patient had returned home one year after hip fracture.

2.11 PREVENTING HIP FRACTURES

While several risk factors for hip fracture are untreatable, research shows that women with untreatable risk factors for hip fracture benefit more from preventative interventions than women who do not have these other risk factors (Cummings,1996). Hip fractures can be prevented either by preventing falls, improving bone strength, or by other means. Please see other methods as discussed in section 2.11.3.

2.11.1 Preventing Falls

Falls are the leading cause of injury death for those over the age of 65. Many of the risk factors for falls are the same as the risk factors for hip fracture and include age-related physiological changes, environmental factors, medications, or diseases. Research has shown that fall prevention should focus on modification of factors such as gait and balance training. This is particularly applicable to those over the age of 79 and/or residents of nursing homes. Environmental modification may be more important for younger elderly and those living in their own homes, although gait and balance still seem to be of primary importance among this group (Norton et al.). An elderly person who has fallen often has a fear of falling again. This may interfere with physical activity and worsen physical function.

2.11.2 Improving Bone Strength

It is unlikely that persons under the age of 50 will break a hip when they fall because their bones are stronger. Hip fracture risk increases three-fold for each one standard deviation decrease in hip bone density (Greenspan, Myers, Maitland, et al.). Therefore, if bone strength were increased, spontaneous fractures and fractures resulting from a fall would not occur. Currently, various factors are being investigated to reduce the incidence and degree of osteoporosis and osteopenia. Factors thought to increase bone strength include: estrogen (Kannis et al.,Kiel et al.), calcitonin (Kannis et al.), anabolic steroids, bisphosphonates, diet (calcium, fluoride, vitamin D), and exercise. With the exception of anabolic steroids, various combinations of these factors are commonly used to increase bone strength.

2.11.3 Other Methods

Primarily, the other method of preventing hip fractures consists of padding devices worn on the hips to cushion the fall. Therefore, if a person with thin bones falls, a fracture can be avoided because the pads cushion the fall (assuming the fracture does not precipitate the fall).

2.12 SUMMARY

Studies have consistently implicated demographic (age, gender), pre-fracture (physical and mental functioning), and social support factors as determinants of poor outcome following hip fracture. While extensive research has gone into identifying risk factors for mortality, other outcomes (institutionalization and health perception) have been largely overlooked until recently. The literature suggests that risk factors for all three outcomes (mortality, institutionalization, and lowered health perception) may be similar, however more research is needed to confirm this. This study examines risk factors identified in previous studies to determine those patients at high risk of poor outcome (mortality, institutionalization, or lowered health perception).

CHAPTER 3

METHODS

3.0 METHODS

3.1 STUDY DESIGN

This study was a population-based prospective cohort study. All Edmonton area hip fracture patients (over the age of 64) admitted to Edmonton hospitals were followed. A small number of patients may have fractured a hip and undergone surgery outside the Edmonton area. These patients were not included in the study. The study period extended over a 13.5 month period, from July 10, 1996 through August 31, 1997. The first (baseline) interview was an in-person interview in the hospital, within the first week following the hip fracture. In addition to demographic information, some functional information on refusals or those dying before being interviewed was collected from medical records. Most research indicates that risk of poor outcome is elevated for three to eight months following the hip fracture. Therefore, the follow-up interview was conducted by telephone, three months post-fracture.

All information was obtained directly from patients if they were English-speaking and had adequate cognitive status, or from next of kin/caregivers otherwise. Some of this information may be subject to recall and/or ascertainment bias; however, the purpose of this component is to identify individuals at risk, using the information that would normally be available at the time of hospitalization.

Demographic information (please see Appendix 3), as well as information on pre-fracture and post-fracture mental and physical status was collected. Demographic information included age, gender, marital status and pre-fracture residence (long term care or not). Socioeconomic factors included years of education and occupation before retirement. Pre-fracture information on overall health perception, social support and physical function was recorded. Post-fracture information on these same variables also was collected. Information obtained from the chart included fracture site, fracture treatment, amount of rehabilitation, discharge site, comorbidities, and complications.

Of 610 patients eligible for inclusion in the study, 470 (77%) completed a baseline interview. Of the 140 non-participants; 48 (34%) refused, 36 (26%) died before being interviewed, 18 (13%) had no available proxy, and 38 (27%) did not participate for various other reasons. Calculations using the statistical package EGRET (EGRET) (Table 3.1) indicate that a sample size of 338 (the sample size for the institutionalization analysis) (please see Chapter 4) is adequate to test the hypotheses of interest (please see section 3.7) at a level of significance of .05 and statistical power of between 90% and 95%. These calculations were based on assuming an odds ratio of 2 for gender; 9 for low as compared to high mental status; 3 for each of young to middle and middle to old age; 5 for low as compared to high function; and 1.5 for the other variables (comorbidities, occupational prestige, education, social support, and health perception).

Table 3.1 Sample Size For Various Power and Alpha Levels

	SAMPLE SIZE AT ALPHA LEVEL				
POWER	**.2**	**.1**	**.05**	**.02**	**.01**
80	125	171	217	277	322
85	149	199	248	312	360
90	182	237	290	359	411
95	237	299	359	435	492
99	359	435	507	597	663

3.2 SELECTION OF COHORT

Patients were eligible for inclusion into the study if they were over the age of 64 and were admitted with a hip fracture to either of the two acute care facilities in Edmonton during the study period. All patients suffering a hip fracture in Edmonton would be treated at one of these two facilities. Patients were excluded if they resided in an area that was a long distance telephone call from Edmonton, had previously fractured the same hip within the past five years, or if their hip fracture could be attributed to some pathological condition such as Paget's disease or bone cancer.

All patients considered for entry into the study were identified from computerized patient lists of the orthopedic wards at each of the two acute care hospitals in Edmonton. Those eligible for inclusion in the study were then determined by the cardex on each ward. Lists of hip fracture patients admitted to each hospital were obtained from medical records as further confirmation that all hip fracture patients were contacted for inclusion into the study. The International Classification of Disease 9th Revision (ICD-9) injury codes used to compile these lists were 820.00-820.9, 808.0, and 808.1.

3.3 INSTRUMENTS AND INDICES

This study was part of a larger study that followed hip fracture patients over a one-year period. Therefore, while the questionnaires (Appendices 4-9) were developed from a combination of the following measurement scales, not all of this information was used in the data analysis to address the hypotheses related to this study. Section 3.4 defines the variables used in different components of the data analysis.

3.3.1 Instruments

The Mini-Mental State Exam (Folstein, Folstein, McHugh) (Appendix 5), the Barthel Index (Shah, Roy) (Appendix 4), The Hip Fracture TyPE Specification, the SF-12 (MacKenzie et al.) , the Older Americans Resources and Services (Kane and Kane) and the EuroQol (Brazier) have been validated and shown to be reliable on the frail elderly population. Information for the Barthel Index was collected from the nurse or physiotherapist and the Mini-Mental State Exam was applied prior to the rest of the questionnaire to determine mental status. Therefore, these two instruments were kept separate from the rest of the questionnaire. For the baseline interview, the wording of the following instruments was altered to refer to the one-month period before hip fracture. Please see questionnaires in Appendix 6 and 7 for the patient baseline and proxy baseline interview form respectively. The three month follow-up questionnaires are contained in Appendix 8 (patient) and Appendix 9 (proxy).

Mini-Mental State Exam (MMSE): The MMSE originally was developed as a simple, quick assessment of mental status, requiring 5-10 minutes to administer. Compared to other short mental status questionnaires, it is quick to administer and has high sensitivity (87%) and specificity (82%) to detect dementia (Anthony et al). It consists of two parts: the first part involving orientation or memory; the second part requiring reading, writing, and following commands. It is generally accepted that a score of 24 or above indicates good mental functioning. However, some research has shown (Anthony et al) that the MMSE score is related to education and age, and for patients over the age of sixty, a score of 21 or more is acceptable; 21 was the cut-off point used in this study. Those scoring 21 or above were deemed mentally competent and interviewed personally, while a proxy was interviewed for those scoring below 21.

The Barthel Index : This index was developed originally to assess self-care ability during rehabilitation for those with musculoskeletal or neuromuscular disabilities. It can be used in any adult population. The Barthel Index assesses the dimensions of feeding, moving from wheelchair to bed and back, hygiene, moving onto and off the toilet, bathing, walking, negotiating stairs, dressing, bladder and bowel control. The result is a score between 0 (poor) and 100 (excellent).

Hip Fracture TyPE Specification: This measurement tool was designed by the Health Outcomes Institute (Health Outcomes Institute) for use in the Outcomes Management System, and was developed by health professionals as an easily administered tool to evaluate outcomes following hip fracture.

SF-12: This questionnaire was shortened from the SF-36, a questionnaire developed by the Rand Corporation, for use in the Medical Outcomes Study (MOS) (Ware and Sherbourne). It originally was developed using criteria from the full-length (MOS) scale. The SF-36 was designed for use in clinical and research settings, for the evaluation of health policy, and for general population surveys. It is applicable to diverse populations of adults. The dimensions assessed include function, pain, physical well-being, mental health, vitality, social factors, and role limitation caused by physical or emotional stress. Whereas the SF-36 has 36 items to answer, the SF-12 has only 12, making the administration time shorter, resulting in less overlap with other instruments used in the interview. The SF-12 yields a physical component score (PCS) and a mental component score (MCS).

Older Americans Resources and Services (OARS): The OARS measurement scale was originally intended to be used to assess function (physical, psychological and social) and utilization of services. It assesses the dimensions of physical health, mental health, activities of daily living (ADL), social resources, and economic resources. The social resources component was used to assess the patient's social support, and the other components were not used in the study.

EuroQol: This is a standardized, generic instrument for measuring health-related quality of life. Mobility, self-care, level of activity, amount of pain, and anxiety/depression are measured. In addition, the patient is asked to score their current health on a scale from 0 to 100, with "0" being "worst imaginable health" and "100" being "best possible health". Owing to the highly subjective nature of this measure, this information could not be collected for the proxy interviews.

3.3.2 Indices

Revisions of the Pineo-Porter-McRoberts Socioeconomic Classification of Occupations for the 1981 Census: The Pineo-Porter Occupational Prestige scale, developed by Peter Pineo and John Porter in 1967 (Pineo and Porter), was the first Canadian scale of occupational prestige. In the same year, Bernard Blishen (Blishen) used this scale, in combination with income and education data from the 1961 census, to develop a socio-economic index for occupations in Canada. This index has undergone periodic revisions to reflect changes occurring in the labour force over time, the most recent version being based upon the 1981 census. This index places each occupation into one of 16 socioeconomic categories, "one" being the lowest socioeconomic group (farm labourers) and "sixteen" being the highest (self employed professionals).

Charleson Comorbidity Index: This index was developed for use in longitudinal studies as a simple method of adjusting for the number and severity of comorbid disease. It has been validated on a sample of breast cancer patients, and there is no reason to believe that it should not apply to this population of hip fracture patients (Charleson).

3.4 THE VARIABLES

3.4.1 Definition of the Variables

The following variables were used in at least one of the analyses:

- Age: Chronological age was calculated as the number of years between the birthdate and fracture date for the patient.
- Occupational prestige: The patient's own occupation before retirement was assigned to one of sixteen occupational prestige categories, with 1 being lowest in prestige and 16 being highest.
- Education: The educational level achieved by the patient.

- Comorbidities: The number of comorbidities affecting each patient.

- Cognitive status (dementia): The decline in cognitive functioning as measured by the Mini-Mental Exam. Not all patients were able to complete the full Mini-Mental Exam as a result of deafness, blindness, or inability to write. To evaluate mental status, the patient's score was divided by the total points possible on the parts of the examination the patient was able to complete. In general, all patients were able to complete the first part of the exam requiring memory and orientation. Some patients were unable to complete the second part of the exam requiring reading and writing. While this may introduce some small bias in scores, it was felt that those with dementia could be clearly identified by completion of the first part of the exam.

- Social Support (Pre-fracture and Post-fracture): This determinant was measured by asking the respondent: is there anyone to give you any help at all if you were sick or disabled?

- Health Perception (Pre-fracture and Post-fracture): The respondents were asked to choose one of five categories, ranging from excellent to poor, that best describe their general health both pre-fracture (baseline interview) and at the present time (three-month interview).

- Function: This component, measured by the Barthel Index, judged an individual's ability to look after himself/herself on a scale between 0 (poor) and 100 (excellent).

3.4.2 Coding of Variables

The possible values for the variables were as follows:

• Age	patient age in years
• Gender	0.female 1.male
• Marital status	1. married 2. single 3. widowed 4. divorced 5. never married 6. other
• Nursing Home	0. community 1. long term care facility

- Occupational Prestige*
  1. farm labourers
  2. unskilled manual
  3. unskilled clerical sales and service
  4. semi skilled manual
  5. semi skilled clerical sales and service
  6. farmers
  7. skilled crafts and trades
  8. skilled clerical sales and service
  9. foremen and women
  10. supervisors
  11. middle management
  12. technicians
  13. semi professionals
  14. high level management
  15. employed professionals
  16. self employed professionals

*Women who had never worked outside the home (housewives) were assessed as being in category two (unskilled manual). While this may underestimate the prestige of some women, it was recognized that no formal education or skill is necessary to be a housewife. Women who listed two occupations, such as farmer/housewife were put in category six (farmer). Where two occupations were listed, the first was used in the assignment of the prestige score.

- Education
  1. none
  2. some/complete elementary
  3. some/complete junior high (grades 7-9)
  4. some/complete high school (grades 10-12)
  5. some/complete non-university degree (technical)
  6. university diploma/certificate
  7. university bachelor's degree
  8. professional degree (vet, doctor, dentist, lawyer)
  9. university master's degree
  10. university doctorate

- Comorbidities — number of comorbidities (ranging from 0-10)
- Dementia — proportion of MMSE score over total possible score (score of .7 or less, corresponding to an MMSE score of 20 or less, indicating some dementia)

Social support	1.no one to help me 2.don't know if there is anyone to help me 3.there is someone to help me
Health perception	1.excellent 2.very good 3.good 4.fair 5.poor
Function	Barthel score (feeding, mobility, hygiene)
Institutionalization	For respondents who were community-dwelling before their fracture: 0.Community-dwelling three months after fracture 1.Institutionalized three months after fracture
Mortality	0.Did not die within three months after fracture 1.Died within three months after fracture
Goal**	Pre-fracture Barthel score – post-fracture Barthel score

**Used in the LISREL analysis only.

3.5 OUTCOMES OF INTEREST

The following outcomes were of interest in this study:

- Mortality;
- Continuing care placement: Resident of a continuing care facility (auxiliary hospital, nursing home, assisted living situation, family care home, or personal care home);
- Overall health perception.

3.6 THE ACTION OF ONE VARIABLE ON ANOTHER

The mechanism through which the independent variables are expected to influence the outcomes of interest is not always clear, and therefore these mechanisms are described below.

- Age: Age-related physiological changes lead to dementia, change in function and health perception.
- Occupational prestige: One mechanism through which income influences health perception and function by facilitating access to health-promoting commodities (health care, diet, exercise, etc.). The correlation between occupational prestige and family income has been estimated by some researchers to be relatively small (0.45) (Abramson). However, Gin and Arbor (1991) found occupation to be the major determinant of income and assets after retirement, indicating occupational prestige may be the best measure of access to health care among this population. Another issue is how to best measure income for women. In measuring health among elderly women, research has shown that it makes no difference if the woman's last occupation or her husband's last occupation is used (Ginn and Arbor, 1993). This is likely because only a small proportion of these women are still married (28% in this sample), and marriages tended to occur among those with similar backgrounds and educational levels. Therefore, the patient's own occupational prestige in their last job before retiring was used to measure access to health-promoting commodities.
- Education: Those with more education are more likely to choose health-promoting lifestyles, because they have the ability to anticipate the benefits to future health of adopting healthy lifestyle choices. This, in turn, will influence health perception and function.

- Comorbidities: The healthier a respondent is, the easier it is for him/her to recover and return to their home.
- Dementia: As indicated in section 2.10, mental functioning has a profound effect on all aspects of the recovery process following a hip fracture.
- Social Support (Pre-fracture and Post-fracture): Research examining the role of friendship and emotional support on health has focussed primarily on the marital relationship, availability of social support (someone who can provide physical and emotional support) and social network size (family and friends). Evidence indicates it is the quality of the relationship rather than the quantity that is most important to well-being (Birren). Having one person that can be trusted and relied upon when needed is most important. The relevance of social support in recovery from hip fracture has been discussed in section 2.10.
- Function (Pre-fracture and Post-fracture): The importance of function in recovery also has been discussed in section 2.10.
- Goal (used in the LISREL analysis only): Has no indicator. It is referred to as a "phantom variable". It is calculated within the program as the difference between the post-fracture function minus the pre-fracture function. In determining how health perception three months post-fracture is influenced by function, there is some research to show (Birren) a respondent will compare their function at three months with their function before fracture. If a respondent makes this comparison and realizes they cannot do now what they could do before their fracture, their health perception will be negatively influenced. Alternatively, if a patient feels they can do everything now that they could do before, health perception should be positively influenced.

3.7 HYPOTHESES

The hypotheses of the study were:

- **Mortality** will be higher in those with poor social support, lower pre-fracture function and health perception, and those with less education and occupational prestige.
- **Long term care placement** (institutionalization) will be more likely for those with poor social support, lower function and health perception, and those with less education and occupational prestige.
- **Perceived health at three months** will be higher in those with more social support, higher functional status and pre-fracture health perception, and those with more education and occupational prestige. Please see LISREL model (Chapter 5).

3.8 ETHICS

This study was conducted with the prior approval of the ethics committee. Issues of informed consent, and the use of proxies to provide information when the patient is deemed mentally incapable were addressed by this committee. In some cases, only verbal consent was obtained, but for most of the respondents consent forms were completed and kept on file. The information sheet and consent form distributed to the respondents is contained in Appendix 1 (patient) and Appendix 2 (proxy).

3.9 DATA COLLECTION PROCEDURES

All hip fracture patients received care in one of two Edmonton hospitals: the University of Alberta Hospitals (University Hospital) or the Royal Alexandra Hospital. Baseline interviews were collected by two interviewers, one responsible for the University Hospital, and the other responsible for the Royal Alexandra Hospital. Three-month follow-up interviews were assigned in a similar manner, with one interviewer responsible for the University Hospital and the other for the Royal Alexandra Hospital. One researcher was responsible for all the chart reviews (Elaine Belseck) for both hospitals. Data entry was divided between two researchers (Marilyn Cree and Dennis Michaelchuk). Each entry was scrutinized for accuracy (the researcher entering the data would go back and check the accuracy of the entry before proceeding on to the next entry) as it was entered.

The initial contact with the patient usually was within the first week after the fracture. The timing of the interview depended on the mental status of the patient, with some patients well enough to be interviewed within a day following their fracture. Other patients, particularly those who were delirious, could not be interviewed for several days after their fracture. In keeping with the study protocol, one of the primary objectives was to attempt to interview these patients before they were discharged. This presented a challenge because, while the care map suggests that these patients should be discharged on day four of their hospital stay, there was a large variation in number of days these patients spent in hospital. There were patients who were discharged before they could be interviewed, and these patients were subsequently contacted at the location to which they had been discharged. Ten patients were missed in hospital because they were admitted to wards other than the orthopaedic wards. Efforts were made to collect demographic information on these patients and follow-up telephone contact was made to determine outcome measures. Demographic information also was collected on those patients who refused to participate in personal interviews.

For those patients who were not English-speaking, a proxy was interviewed and no mental assessment was done. For those patients who were English-speaking and consented to participate in the study, mental status was then assessed. Full personal interviews were conducted with those patients who had adequate cognitive status. Proxies were contacted by telephone to supply interview information relating to the patients with poor cognition. The proxies usually were the patient's next-of-kin or their caregiver. Verbal consent from the proxy was obtained over the 'phone and written consent was obtained afterwards.

Studies of proxy vs. self-report (Magaziner et al.) have found that proxies who are well-acquainted with study participants tend to overestimate patient disability in comparison with patients themselves. Care was taken to ensure that questions were worded to elicit objective information (not opinions) on clearly-defined activities in order to maximize the accuracy of proxy responses. While there would be some bias from proxy responses, particularly on the health related quality of life questions, this was to be taken into account in the LISREL analysis by allowing for measurement error.

Participants were contacted 2.5 months to 3.5 months after their original interviews in order to obtain information for the three-month follow-up phase of the study. Follow-up contact was successful for almost all patients because the follow-up period was quite short.

3.10 DATA ANALYSIS

The question of interest is whether there are variables, identifiable at the time of admission, that would serve to identify patients at high risk of poor outcomes. Toward this end, the goal of the data analysis for this study was to estimate relative risks for the different outcomes, and also to develop a model to predict outcomes, based on variables that were examined and found to be important. All testing was done at the 0.05 level of statistical significance (two-tailed).

Often the results in Chapter 4 and 5 were rounded to the nearest tenth or to the nearest whole number. For example, a proportion of 61.465% would be rounded to 61.5% which may then be further rounded up to 62%. While this number could also have been rounded down to 61%, it was felt that either 61% or 62% were accurate enough to allow for comparisons of the characteristics of the various samples used in the analysis.

3.10.1 Logistic Regression

Logistic regression is used to examine the relationship between a dependent variable that is dichotomous, and several independent variables. Therefore, logistic regression can be used to examine the relationship between poor outcome or good outcome (dependent variable) and the independent variables. Separate regressions were performed for each of the outcomes of interest (mortality and long-term care placement) as follows:

- Controlling for gender, age, dementia, comorbidities, and pre-fracture residence in a continuing care facility, logistic regression was employed to examine the relationship between mortality and the socioeconomic variables, social support, function, and health perception.
- Controlling for gender, age, dementia, and comorbidities, logistic regression was employed to examine the relationship between institutionalization and the socioeconomic variables, function, social support, and health perception.

3.10.1.1 GENERAL LOGISTIC REGRESSION MODEL

The probability of a poor outcome is denoted as 'p'. Then (p/(1-p)) is denoted as the odds of a poor outcome. A linear relationship is hypothesized between the independent variables (x's) and the log of the odds of poor outcome (the dependent variable). The model is indicated below:

$$\ln(p/(1-p))=\alpha+\beta_1 x_1+\beta_2 x_2+\ldots+\beta_p x_p.$$

3.10.1.2 THE LOGISTIC REGRESSION ESTIMATES

Maximum likelihood estimates of α and the β's were calculated by maximum likelihood estimation techniques involving an iterative process of testing values of coefficients until the set of coefficients are found that maximizes the likelihood function (L). The likelihood function is the probability of obtaining the particular sample, given that the specified logistic model is true.

3.10.1.3 INTERPRETATION OF THE ESTIMATES

For a given coefficient, b_1, a one unit increase in the value of the corresponding independent variable is related to an average increase of b_1 in the log odds of the dependent variable. This is difficult to understand and for this reason the equation is interpreted in terms of probabilities (prob) or odds ratios (OR) instead of log odds of the dependent variable:

$$\text{Prob. of an outcome} = \frac{e^{(a+b_1x_1+\ldots+b_kx_k)}}{1+e^{(a+b_1x_1+\ldots+b_kx_k)}}$$

e.g. OR for a one unit increase in $x_1= e^{(b_1)}$

Where 'e' is an irrational number approximately equal to 2.718.

For rare diseases (prevalence or cumulative incidence of 20% or less) the OR is an estimate of Relative Risk (RR) and measures the risk of developing disease in those exposed to the variable of interest as compared to those not exposed to the variable of interest. An OR greater than unity means there is increased risk of disease among those exposed (a deleterious effect) while an OR less than unity means those exposed have less risk (a protective effect). An OR of one indicates no exposure effect.

In the case of a dichotomous independent variable such as gender, the OR (e^{b}) is the estimate of interest. For a continuous independent variable such as age, it is usually of interest to examine the change in risk associated with an increase of several (perhaps 'm') years. Then the estimate of interest is e^{mb}.

Using these estimates, the probability of a poor outcome can be estimated for a patient with a particular set of characteristics. For example, it may be of interest to estimate the probability of death for an otherwise healthy 85 year old male currently living in his own home. This probability can be estimated using this model. The interpretation of the coefficients requires that all other independent variables in the model are held constant.

3.10.1.4 Significance of the Variables

To test for the significance of an independent variable, the test statistic involves the calculation of $-2^{*}\ln(L)$, where $\ln(L)$ is the natural logarithm of the likelihood function. This quantity is calculated for the logistic model without the particular independent variable included. This quantity is also calculated for the logistic model with the particular independent variable included. The test statistic, called the likelihood ratio (LR) statistic is the ratio of these two quantities and this statistic has a chi-square distribution when the null hypothesis (i.e., the independent variable has no effect) is true.

An alternative test statistic, the Wald statistic, calculates the ratio of the estimate over its standard error. When the null hypothesis is true (i.e., no effect of the independent variable) this statistic has a normal distribution.

3.10.1.5 Logistic Regression Diagnostics

The logistic regression model assumes a linear relationship between the independent variables and the logit ($\ln(p/1-p)$). It is important for the interpretation of continuous independent variables to ensure that risk increases linearly. There are various methods to detect nonlinearity of a continuous variable in the logit, but one simple method is use of the Box-Tidwell transformation (Hosmer and Lemeshow). "The Box-Tidwell approach adds a term of the form xln(x) to the model. If the coefficient for this variable is significant we have evidence for non-linearity in the logit" (Hosmer and Lemeshow). If the continuous variable is nonlinear in the logit, categorizing should be contemplated.

Highly correlated independent variables can cause estimation problems. These are usually manifested as large estimated standard errors of the coefficient, and can sometimes result in unexpectedly large values of the coefficient. To detect this, the bivariate correlations should be examined. Correlations of approximately 0.9 or greater could indicate this problem.

3.10.1.6 VARIANCE EXPLAINED BY THE MODEL

In an overall assessment of the model, it is of interest to know how much of the variation in the dependent variable is explained by the regression. This is indicative of how accurately the dependent variable can be predicted from the independent variables. In multiple regression this value is called R-square and is calculated as the ratio of the explained sum of squares over the total sum of squares. In logistic regression it is possible to calculate a measure which approximates R-square, called R_L^2 (Hosmer and Lemeshow), as below:

$$R_L^2 = \frac{-2\log L_0 - (-2\log L_1)}{-2\log L_0}$$

L_0 is the value of the likelihood function for the model containing the estimated intercept only and L_1 is the evaluation of the likelihood function for the model containing the estimates for all the parameters. The total sum of squares would be represented as $-2\log(L_0)$ and $-2\log(L_1)$ would estimate the residual sum of squares, resulting in a value of R_L^2 of between 0 and 1. The closer to unity this value is, the better the model explains the dependent variable. This is only an approximation to R-square because doubling the log likelihood has no practical interpretation.

3.10.2 Multiple Regression

Multiple regression is used to examine the relationship between a continuous dependent variable and a set of independent variables. Therefore, multiple regression can be used to study the relationship between health perception (dependent variable) and the following independent variables:

- Controlling for gender, age, dementia, and comorbidities, multiple regression was used to predict the dependent variable (post-fracture health perception) from the socioeconomic variables (education and occupational prestige), social support, function, and pre-fracture health perception.

3.10.2.1 GENERAL LINEAR REGRESSION MODEL

The outcome, denoted as y , is assumed to be linearly related to each of the independent variables (x's). The error term is denoted as 'ε'. The model is as follows:

$$y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_p x_p + \varepsilon$$

While the error cannot be observed, it is assumed that the errors are independent, normally distributed, with mean of 0 and constant variance. The error terms also are assumed to be independent of the x's. Therefore, there are a number of assumptions that are necessary in order to make inferences about the estimated coefficients.

The fitted model is of the form:

$$y=a+b_1 x_1 +b_2 x_2 + \ldots +b_p x_p +e$$

In this equation, the 'e' denotes the residual.

3.10.2.2 THE REGRESSION ESTIMATES

The values of 'a' and 'b' are the least squares estimates of α and the β's. The least squares estimates are calculated by minimizing the sum of the squared residuals.

3.10.2.3 INTERPRETATION OF THE ESTIMATES

For a coefficient, b_1, a one unit increase in the corresponding independent variable results in an expected increase of b_1 in the dependent variable, keeping all other variables constant.

The model also can be used for predictive purposes. Using these estimates, the expected health perception for a patient with a particular set of characteristics can be estimated. For example, it may be of interest to estimate the average health perception, three months after fracture, for a seventy year old woman who was healthy and living in the community before fracture. The interpretation of the coefficients requires that all other independent variables in the model are held constant.

3.10.2.4 VARIANCE EXPLAINED BY THE MODEL

The multiple coefficient of determination (R-squared value) indicates the amount of variation in the dependent variable (y) that is explained by the regression equation. It is the ratio of the explained sum of squares (calculated by subtracting the residual sum of squares from the total sum of squares) divided by the total sum of squares. This results in a number between 0 and 1, and the closer to one it is, the better the model is in explaining the dependent variable.

Berry and Feldman claim there are at least three reasons why the R-square value may be low. Often important variables have not been included in the analysis (specification error), which is a problem with theory and cannot be corrected in the analysis. Alternatively, there could be large amounts of measurement error in the variables or the model could be misspecified.

3.10.2.5 SIGNIFICANCE OF THE VARIABLES

To assess the impact of a unit change in an independent variable on the dependent variable, it is important that the variables not be highly correlated. Correlations among independent variables of .9 and above are considered high, and can indicate multicollinearity with resultant estimation problems. Multicollinearity is not such a problem if the purpose of the regression analysis is to find the best model for predictive purposes.

For each of the estimated coefficients, a t-statistic is calculated, along with a corresponding p-value. Usually, coefficients with p-values of .05 or less are considered significantly different from 0. This is not applicable in every analysis and depends on the research question and the statistical power of the study.

3.10.2.6 REGRESSION DIAGNOSTICS

The regression model makes some assumptions on the error terms and on the variables. A discussion of these assumptions follows.

Multicollinearity: to obtain precise estimates, there cannot be high correlations among the independent variables. To detect this, the bivariate correlations should be examined and the variance inflation factor (VIF) considered. When multicollinearity is a problem, the standard error of the estimate is inflated. The VIF is an indication of how much the standard error is inflated. For example, when the square root of the VIF is equal to 2, this means that the accuracy of the estimate is halved. Results of this magnitude or greater indicate multicollinearity is a problem.

Normality of the Distribution of the Error Terms: as long as the sample size is large, valid inferences can be made using the least squares estimators (by application of the Central Limit Theorem). However, when the error terms are not normally distributed, the least squares estimators may not be the optimal in terms of efficiency. A histogram of the residuals or a normal Q-Q plot can detect departures from normality among the error terms.

Error Variance: one of the assumptions of the model is that the error terms have constant variance over the regression surface. If this is violated (heteroscedasticity) the least squares estimators are inefficient and the standard errors of the coefficients are incorrect. Plots of the studentized[1] residuals versus the fitted y-values (Fox) and the residuals versus each of the x-values may reveal patterns of changing error variance. Fox indicates it is worthwhile correcting for heteroscedasticity (through a transformation or using weighted least squares estimates) if the variance differs by a factor of three or more.

3.10.2.7 DISCRETE DEPENDENT VARIABLE

While the dependent variable in the regression analysis should be continuous, it is possible to have a discrete dependent variable (with at least five categories), as is the case with this analysis. In this case, the error terms will not be normally distributed with constant error variance. However, as long as there is a reasonable amount of spread among the data, efficient estimates are possible (Fox).

3.10.3 LISREL Model

LISREL (LInear Structural RELations) is a type of structural equation modeling. Linear structural equation models are made up of one or more linear structural equations, a simple linear regression line (y=a+bx) being the most elementary type of structural equation model.

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[1] Fox recommends using the studentized residuals "because the least squares residuals have unequal variances even when the errors have constant variance".

While there are several differences between this form of modeling and regression analysis, two are particularly pertinent to this project:

1. Structural equation models allow for indirect effects. For example, the model specifies that age influences an individual's health perception directly (direct effect). However, age also causes dementia, and dementia influences an individual's health perception (indirect effect). For variables on the same causal pathway (e.g.: age causing dementia and dementia influencing health perception) the indirect effect between the two variables (e.g.: between age and health perception) can be calculated by taking the product of the coefficients of two or more regressions. In this example, regressing dementia on age will result in a coefficient (b_1) reflecting the change in dementia as age increases. Regressing health perception on dementia yields another coefficient (b_2) which indicates the change in health perception as dementia increases. The indirect effect between age and health perception will be the product of b_1 and b_2.
2. Structural equation models adjust for measurement error. This is particularly relevant to this model in relation to the proxy responses. Studies have shown that there could be some inaccuracy in proxy response, and that this inaccuracy is particularly noteworthy in the more subjective areas such as health perception. This model can adjust for this type of measurement error.

The LISREL model is comprised of variables (latent variables or concepts) that are indirectly observable through the action of other variables (indicators of the latent variables). For example, dementia is a latent variable and MMSE is the indicator of dementia. There are two parts to a LISREL model: the first part (structural or conceptual model) examines the causal effects among the latent variables; the second part (measurement model) is concerned with how well the indicators measure the latent variables (validity and reliability). In addition, there are two types of latent variables: those that are caused by other concepts in the model (endogenous) and those that are only causes of other concepts (exogenous).

Based on existing literature, LISREL will be used to determine which of the anticipated variables influence perceived health at three months. Please see LISREL model (Chapter 5).

3.10.3.1 THE GENERAL LISREL MODEL

LISREL is a method of estimating coefficients for the set of three matrix linear structural equations defining the model:

1) $\eta=\beta\eta+\Gamma\xi+\zeta$
2) $y=\Lambda_y\eta+\varepsilon$
3) $x=\Lambda_x\xi+\delta$

Equation (1) is the conceptual model, where the η's are the endogenous concepts, the ξ's are the exogenous concepts, the ζ's are the error terms, and the β's and Γ's are the structural coefficients.

Equation (2) is the measurement model for the endogenous indicators, y. The ε's are measurement errors, and the Λ_y are structural coefficients.

Equation (3) is the measurement model for the exogenous indicators, x. The δ's are measurement error, and the Λ_x are structural coefficients.

Each structural coefficient represents the expected change in the dependent variable as the independent variable increases by one unit, all other variables in the model left untouched.

The following assumptions apply to the LISREL model:

1. ζ and ξ are uncorrelated
2. ε and η are uncorrelated
3. ξ and δ are uncorrelated
4. ζ, ε, and δ are uncorrelated
5. I-B is non-singular (the matrix I-B is the difference between the identity matrix (I) and the structural coefficients between the concepts (B)).

Traditionally the exogenous and endogenous concepts have been separated from each other (equations (2) and (3)) but all models can be expressed in terms of η's only. These models are called "all-eta models". An all-eta LISREL model was used with these data. The advantage of doing this is to gain additional diagnostics that uncover how some of the exogenous concepts influence some of the endogenous indicators. This also simplifies the structural equations, with equation (3) being dropped and equation (1) being modified as follows:

$$1)\ \eta=\beta\eta+\zeta$$
$$2)\ y=\Lambda_y\eta+\varepsilon$$

3.10.3.2 THE LISREL ESTIMATES

The data are input into LISREL in the form of a sample covariance matrix [2] (denoted as S) among the observed variables. LISREL also calculates a model-implied covariance matrix, denoted as sigma (Σ), based upon the implications of the model. This model-implied covariance matrix is based upon the recognition that each effect in the model implies the existence of a series of covariances among the variables.

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[2] The covariance matrix used in the LISREL run can be calculated using listwise deletion or pairwise deletion. Using listwise deletion, any respondent missing a value for any variable will be deleted prior to the calculation of the covariances. This means that the matrix will be created based on those respondents with complete information available. An individual with accessible information on each pair of variables of interest will be included in the construction of a pairwise covariance matrix . The difference between these two methods is that the listwise covariances are all calculated from the same group of respondents whereas for the pairwise procedure different covariances may be based on different sets of individuals. Either method may cause some distributional problems if there is missing data. The listwise covariances, assuming no missing data, have a known (Wishart) sampling distribution, however the distribution of the pairwise covariances is unknown. A disadvantage of listwise deletion is that it can lead to the exclusion of large amounts of data from the analysis when there are significant numbers of missing observations. An advantage of the pairwise deletion method is that it allows for all the data to be used.

In the absence of specified starting values for the maximum likelihood estimates, LISREL will calculate initial start values. Through a series of iterations using the largest partial derivatives (slopes) of the coefficients, these estimates are improved upon. The final estimates of the coefficients are those that minimize the discrepancy between the sample covariance matrix and the model-implied covariance matrix.

3.10.3.3 INTERPRETATION OF THE LISREL ESTIMATES

For a coefficient, b_1, a one unit increase in the independent variable results in an average increase of b_1 in the dependent variable, all other variables not being modified.

In addition to the coefficients, the LISREL output also contains the model-implied covariance matrix (Σ). Ideally, these covariances will be similar to the observed covariances, with large differences (residuals) indicating problems. "Numerous model features contribute to the modelling of most covariances, and any of these features may be the 'problem' creating the large residual (e.g., the absence of a direct effect, the absence of indirect effects, an omitted reciprocal effect, an omitted common cause, covariances among the measurement errors or structural disturbances, improperly fixed effect coefficients, mismodeled covariances among the background causal variables, use of a completely wrong model, entering the wrong data matrix, or entering a data matrix containing incorrectly coded data)" (Hayduk, 1986). The model-implied covariances are also useful for determining whether a multiple indicator is "proportional" (proportionality constraints) (Hayduk, 1996). This means that the covariance will be some proportion of the variance of the common cause. "The λ estimates determine the specific proportionality constraints that are introduced by the multiple indicator specification, and the reasonableness of these constraints is best assessed by examining whether the proportionally constrained covariances are consistent with the actual observed covariances. For two problematic indicators, the compromise λ estimate will result in some over- and some underestimated covariances which are likely to display themselves as a telltale pattern of large and matched positive-negative standardized residuals for this pair of indicator variables" (Hayduk, 1996).

3.10.3.4 GOODNESS OF FIT OF THE MODEL

The chi-square statistic and its corresponding p-value are a test of the difference between the data covariance matrix (S) and the model implied covariance matrix (Σ). The more similar these two matrices are, the larger the p-value, and the better Σ approximates S.

The Goodness of Fit Index (GFI) compares the fit function of the fitted model to the fit function calculated from the observed covariances only. The closer to one the GFI is, the better the fit of the model.

The Adjusted Goodness of Fit Index (AGFI) is adjusted for degrees of freedom. As is the case with the GFI, the closer to unity the AGFI is, the better the fit of the model. An AGFI of 0.98 or above is preferable however, slightly lower values may also be acceptable.

3.10.3.5 DIAGNOSTIC CRITERIA

The difference between the observed and model implied covariance (fitted residual) is dependent on the scale of measurement. The standardized residual, obtained by dividing a residual by its corresponding asymptotic standard deviation, is a measure independent of the scale of measurement. If there was a perfect fit between the data and the model, the residuals would be zero. The standardized residuals estimate the number of standard deviations between the observed residuals and zero. It is expected that approximately 95% of the standardized residuals will be within two standard deviations of 0, so that large standardized residuals (less than –2.0 or greater than 2.0) indicate a possible problem with the model.

The modification indices are calculated for each fixed coefficient in the model. The modification indices estimate the improvement in fit of the model if a fixed parameter were to be freed. Large modification indices can indicate where improvements can be made to the fit of the model, but any changes resulting from examination of the modification indices are data driven. If changes are made to the model, based on the data, it becomes difficult to test this model with this data. Therefore, only a small number of changes should be made to the model, and these improvements should not be made if there is no theoretically plausible reason.

The standardized coefficients, in the beta matrix of the standardized solution portion of the LISREL output, also indicate the magnitude of an effect. While each indicator retains its original unit of measurement, each standardized concept has a variance of one. Standardized coefficients should have values between zero and one, the closer to one the value is, the larger the corresponding effect. A standardized coefficient greater than one in magnitude is usually a warning of possible estimation problems.

3.10.3.6 ASSESSING SIGNIFICANCE OF THE COEFFICIENTS

While a model may fit the data well, estimates of the coefficients should be accurate (have small standard errors) and not be highly correlated with other parameters in the model (indicating multicollinearity).

A t-statistic can be used to assess whether a coefficient is significantly different from 0. A calculated t-statistic of less than –2 or greater than 2 indicates, at a level of significance of 0.05, that the data indicate that the coefficient does differ from zero.

3.10.3.7 VARIANCE EXPLAINED BY THE MODEL

The squared multiple correlations for the structural equations give the proportion of variance in each concept explained by the model. The closer this value is to unity, the better the concept is explained by the model. For further discussion of the LISREL model, please see Chapter 5.

CHAPTER 4

LOGISTIC REGRESSIONS

MORTALITY

INSTITUTIONALIZATION

4.0 LOGISTIC REGRESSIONS

The data analysis consisted of four components, and different segments of the total sample were used for different components. The choice of the sample is expanded upon in the relevant section below. A brief description of each analysis is presented below followed by a comparison of the demographic characteristics of each sample (Table 4.1). The last column of Table 4.1 compares the demographic characteristics of those respondents providing full information (baseline and three month follow-up) to the respondents involved in the various analyses. Examination of Table 4.1 indicates that the demographic characteristics among the respondents in the various samples are similar, in all respects except pre-fracture residence (analysis 2). This is because analysis 2 (prediction of institutionalization) requires the respondents to be living in the community before the hip fracture.

Analysis number 1: a logistic regression to predict mortality. This analysis uses information collected at the baseline interview to examine determinants of mortality within three months following a hip fracture.

Analysis number 2: a logistic regression to predict institutionalization. This analysis uses information collected at the baseline interview and the three month follow-up interview to identify determinants of institutionalization within three months following a hip fracture.

Analysis number 3: a multiple regression to predict health perception. This analysis uses information collected at the baseline interview and the three month follow-up interview to ascertain those variables related to increased health perception three months following a hip fracture.

Analysis number 4: a LISREL model of health perception. This analysis uses information collected at the baseline interview and the three month follow-up interview to identify those variables that influence health perception three months following a hip fracture.

Table 4.1 Demographic Characteristics of the Various Samples

Variable	Analysis 1[1] (n=558)	Analysis 2[2] (n=338)	Analysis 3[3] (n=367)	Total[4] (n=423)
Average Age (s.d.)	81.4 (7.56)	80.3 (7.22)	81.8 (7.35)	81.0 (7.36)
Gender				
Female(%)	412 (74)	263 (78)	272 (74)	329 (78)
Coming from Community(%)	430 (77)	338 (100)	307 (84)	338 (80)
Hospital University (%)	240 (43)	161 (48)	180 (49)	195 (46)
Marital Status				
Married (%)	137 (25)	101 (30)	105 (29)	115 (27)
Single (%)	36 (7)	19 (6)	21 (6)	23 (5)
Widowed (%)	334 (62)	197 (58)	217 (59)	260 (62)
Divorced (%)	20 (4)	11 (3)	13 (4)	13 (3)
Never Married(%)	6 (1)	5 (2)	6 (2)	6 (1)
Other (%)	6 (1)	5 (2)	5 (1)	6 (1)
TOTAL	539	338	367	423
Education[5]				
Elementary (%)	70 (16)	39 (12)	36 (10)	60 (14)
Junior High (%)	131 (29)	102 (31)	116 (32)	123 (30)
High School (%)	139 (31)	102 (31)	113 (31)	125 (30)
Diploma (%)	77 (17)	55 (17)	58 (17)	66 (16)
University (%)	31 (7)	27 (8)	28 (8)	29 (7)
TOTAL	448	325	351	403
Occupation[6]				
Farm (%)	37 (8)	22 (7)	24 (7)	31 (8)
Blue Collar (%)	242 (53)	170 (52)	176 (49)	220 (52)
White Collar (%)	179 (39)	137 (42)	156 (44)	162 (39)
TOTAL	458	329	356	413

Notes: Percentages may not add up due to rounding

1. Analysis 1 is the logistic regression to predict mortality
2. Analysis 2 is the logistic regression to predict institutionalization
3. Analysis 3 is the regression and LISREL analysis (pairwise covariance matrices used for the LISREL analysis).
4. This group includes all those patients with completed baseline and three month interviews.
5. Elementary includes no schooling, some/completed elementary. Other categories include all those who have some or have completed that educational level.
6. To summarize the data, occupational prestige was collapsed into the three categories often used in studies (Pineo). Pineo suggests collapsing categories as follows: farm includes farmers and farm labourers (categories 1 and 6). White collar includes skilled clerical/supervisory, management and professional (categories 8, 10-16). Blue collar includes foremen, craftsmen, and tradesmen (categories 2-5, 7,9).

4.1 REFUSALS

Of the 610 hip fracture patients, forty-eight were refusals. In ten (21%) of these the patient refused and in thirty-eight (79%) the proxy refused. Seventeen (35%) were living in long term care before their fracture and 38 (79%) were female. The average age among members of this group was eighty-two. Forty-four patients (92%) were either widowed (61%) or married (30%), with another 7% being single.

This group was similar to the samples used for the other analyses in age, gender distribution, and marital status. They differed in having a higher portion of long-term care residents, and therefore, a larger proportion of possible proxy responses. There was a reluctance on the part of some proxies to involve their relatives in a study, particularly when the relative was demented, and it was difficult for the proxy to see the relevance of some questions, or feel they could responsibly answer them on the part of the patient.

4.2 PREDICTION OF MORTALITY

As discussed in Section 2.10, mortality following hip fracture has been extensively studied and various risk factors have been identified. These risk factors included demographic characteristics (age, gender, education and income) as well as pre-fracture and post-fracture variables (social support, health perception, function, and number of comorbidities). This analysis attempts to study these variables as a group, and determine which variables increase risk of mortality.

4.2.1 Description of Sample

This analysis examines determinants of mortality within three months following a hip fracture, and includes those respondents (n=558) for whom some demographic or baseline information has been collected. Only pre-fracture variables were examined because completed three month interviews were not available for those dying within three months following their fracture.

Demographic information only was collected for eighty-seven (16%) of these respondents. This was primarily because the patient died before being interviewed (42%), or a proxy could not be located for an interview (23%). As a result, there was a large number of missing values for some variables. The proportion of missing values for mental status (22%) was the highest, with education (20%) and occupation (18%) also being high.

Forty-two percent of these interviews were patient interviews. Approximately two thirds (68%) had less than four comorbidities, and the average score on the MMSE was 19 out of 30.

Forty-four of these respondents (8%) had died within the three months following their hip fracture, thirty-seven (84%) of these deaths occurring within one month of their injury. Roughly one-third (39%) of those who died, compared to only one-fifth (21%) of those who survived, were residing in long term care before their fracture. Table 4.2 depicts demographic characteristics of those who died compared to survivors. Approximately one-quarter of survivors were male. Almost one half (46%) of those who died were male. While 70% of survivors were under the age of 85, the majority (56%) of those who died were over 85 years old (Table 4.3). The survivors were healthier, with the greater number (53%) having less than three comorbidities while the same proportion of the group that died had more than three comorbidities (some having as many as six comorbidities).

Table 4.2 Demographic Characteristics by Outcome At Three Months

OUTCOME	Male (%)	Average Age (s.d.)	Nursing Home Resident (%)	Average Number of Comorbidities (s.d.)	Total
Died	19 (46)	85.2 (7.9)	17 (39)	3.3 (1.6)	44
Survived	126 (25)	81.1 (7.5)	106 (21)	2.6 (1.8)	504

Table 4.3 Number of Deaths in First Three Months by Gender and Age*

GENDER	AGEGROUP			TOTAL
	65-75 (%)	75-85 (%)	85+ (%)	
Female	3 (14)	4 (18)	15 (68)	22
Male	3 (16)	8 (42)	8 (42)	19

*Age was missing for three of the respondents that died.

There was a noticeable difference in both mental and physical functioning between the two groups (Table 4.4), with the average MMSE score for the survivors being twenty, and the average score for those who died being nine. The pre-fracture function score was 82 for the survivors compared to 49 for the other group.

Table 4.4 Functional Characteristics by Outcome

OUTCOME	Pre-fracture Barthel Score (s.d.) n=556	Average MMSE score (s. d.) n=438
Died	49.1 (39.4)	9 (8.9)
Survived	81.8 (26.3)	20 (9.4)

4.2.2 Bivariate Analysis

The dependent variable for this analysis was mortality within three months. This variable was coded as 0 (survivor) or 1 (died within three months).

Examination of the Pearson correlation coefficients indicate that the highest correlation among the independent variables (0.56) was between mental and physical functioning. From Table 4.5, the bivariate logistic results indicate that increasing age and number of comorbidities increase the risk of mortality. Risk is also elevated for males, those residing in long-term care before fracture, and those with lower mental and physical functioning.

Table 4.5 Summary of Logistic Regression Results To Predict Mortality *

Variable	**Univariate Logistic**		**Multivariate Logistic**	
	OR	**95% C.I.****	**OR**	**95% C.I.****
Age	1.08	1.03, 1.13	1.07	0.97, 1.18
Male Gender	2.3	1.24, 4.38	3.9	0.99, 15.54
Nursing Home	2.4	1.26, 4.55	0.91	0.15, 5.67
Occupational Prestige	0.94	0.84, 1.06	0.92	0.77, 1.11
Education	0.77	.51, 1.15	1.08	0.65, 1.8
Comorbidity	1.24	1.05, 1.47	0.83	0.52, 1.35
MMSE	0.97	0.96, 0.98	0.97	0.94, 0.99
Pre Social Support	0.72	0.43, 1.23	0.69	0.32, 1.5
Pre Function	0.97	0.96, 0.98	0.99	0.96, 1.03
Pre Health Perception	1.007	0.63, 1.6	Not included	

***Note: Pre is abbreviation for pre-fracture**
****Note: C.I. is an abbreviation for confidence interval**

4.2.3 Multivariate Analysis

Hosmer and Lemeshow suggest that any variable with a p-value of .25 or less in the bivariate analysis be considered for inclusion in the multivariate model. Therefore, occupational prestige (p-value of .34) and pre-fracture health perception (p-value of .98) would be excluded for the multivariate analysis. A decision was made to keep occupational prestige in the model, however, to adjust the effect of gender (this is discussed further below).

Comparing the multivariate to the bivariate results, some of the variables that were significant in the bivariate analysis, were not significant in the multivariate analysis. This likely had to do with the correlations among the independent variables, particularly age, residence in a long term care facility, mental status, and number of comorbidities (Table 4.6). For example, residents of nursing homes tend to be older, have more comorbidities, and lower cognitive status than those living in the community.

Table 4.6 Selected Characteristics of Patients by Pre-fracture Residence

RESIDENCE	**Average Age (s.d.)**	**Average MMSE Score (s.d.)**	**Average Number of Comorbidities**
Community	80.6 (7.5)	21.6 (8.1)	2.5
Nursing Home	84.6 (7.1)	7.5 (7.6)	3.4

The coefficient of gender showed a large increase in the multivariate analysis as compared to the bivariate analysis, meaning there were other independent variables that were important to include in the model with gender to adjust its effect. One of the variables correlated with gender was occupational prestige. For example, the majority of females were housewives (36%) or clerical workers (15%), while almost half (47%) of the males were foremen, managers, or professionals. Gender was also correlated with education, with number of years of education being less for females (seven to nine years) as compared to males (ten to twelve years). Gender and education were kept constant in the multivariate analysis. When these two variables were not controlled for, the coefficient of gender (2.5) was similar to the bivariate value. Therefore, males were better educated and had higher occupational prestige, and increases in education and occupational prestige lead to reduced mortality. While occupational prestige and education were not significantly related to mortality, controlling for them served to adjust the effect of gender, which was a significant predictor of mortality.

The multivariate analysis revealed two variables (gender and mental status) significantly related to mortality, when controlling for the other independent variables in the model. These two variables were kept in the model. Occupational prestige and education were also included in the model, despite their insignificance, to adjust the effect of gender. The logistic regression model assumes that there is a linear relationship between the logit ($\ln(p/(1-p))$) and the independent variables. Hosmer and Lemeshow recommend this assumption be verified for the continuous variables still in the analysis at this point. The Box-Tidwell transformation was employed to detect nonlinearity of the logit in mental status (please see section 3.10.3.5 for a discussion of this). The $x\ln(x)$ term in the model (with x representing mental status) rendered an insignificant coefficient for this term ($p=.7$). Therefore, there was no evidence to suggest that mental status was nonlinear in the logit and it was kept as continuous.

The multivariate results also indicate that the risk of death is only 25% for females as compared to the risk of death for males. The importance of gender cannot be explained by differences in physical health (comorbidities, function) or social support. The number of comorbidities and the social support is very similar for both males and females (Table 4.7). The pre-fracture Barthel score is five points lower for males than females, but five points on the Barthel scale is small and would likely not be considered clinically significant.

Table 4.7 Comparison of Health and Social Support by Gender

GENDER	Average Pre-fracture Barthel Score (s.d.) n=556	Average Number of Comorbidities (s.d.) n=557	Percent Having Social Support n=465
Female	80.5 (27.5)	2.6 (1.8)	79
Male	75.7 (32.5)	2.8 (1.7)	77

Based on listwise deletion of missing values for the following variables, these results suggest the equation:

$$\ln(p/(1-p)) = -1.9 + 1.47(\text{gender}) - .03(\text{MMSE}) - .11(\text{occupation}) - .04(\text{education})$$

where: gender=0 if female
=1 if male

From this equation, the estimated odds ratio for a ten unit increase in MMSE score would be $e^{(10*(-.03))}=e^{(-.3)}$ which is .74. For example, a male scoring 22 on the MMSE has a 26% reduction in the risk of death of another male with MMSE score of 12 (assuming the same occupational prestige and educational level for both males). It is also possible to estimate the increased risk related to low as compared to high mental status. Low mental status is usually defined as a MMSE score of 20 or less, while a score above 20 indicates high mental status. Ten is the midpoint of the low category and 25 is the midpoint of the high category, with the difference between these two numbers being 15. The estimated odds ratio for a 15 unit difference in MMSE score would be $e^{(15*(-.03))}=e^{(-.45)}=.64$. Therefore, an individual with high mental status has an estimated 36% reduction in the risk of death as an individual of low mental status (gender, occupational prestige, and educational level kept the same for both individuals).

Using the formula in 3.10.1.3, and substituting the average score for males on the MMSE (18), occupational prestige (8), and education (4), the probability of death for an average male with poor mental functioning can be calculated by setting x_1 equal to one, x_2 equal to 18, x_3 equal to 8, and x_4 equal to 4:

$$\text{probability} = \frac{e^{(-1.9+1.47x_1-.03x_2-.11x_3-.04x_4)}}{1+e^{(-1.9+1.47x_1-.03x_2-.11x_3-.04x_4)}}$$

In the same way, the probability of death for an average female (MMSE score of 19, occupational prestige of 6, and average education of 3), can be calculated by setting x_1 equal to zero, x_2 equal to 19, x_3 equal to 6 and x_4 equal to 3. The probability of death within three months following hip fracture for the average male in the sample was 0.12, approximately four times the probability of the average female in this sample (probability of .03).

As stated in section 3.10.3.5, an estimate of the amount of variance explained by the model can be calculated by:

$$R_L^2 = \frac{-2\log L_0-(-2\log L_1)}{-2\log L_0} = \frac{99.61-78.9}{99.61} = .208$$

Therefore, approximately 21% of the variation in the model containing only the intercept term is explained by the model that also contains mental status, gender, occupational prestige, and education. This is very low, and is likely due to the fact that there are other explanatory variables that have not been included in the analysis. It is difficult to speculate as to what these may be, because most of the variables that have been found to be significantly related to mortality in other studies have been included. Three variables in particular (age, comorbidities, and pre-fracture function) have been found to be significant in other studies.

4.2.4 Best Predictive Model

To find the best predictive model, an interaction term between gender and MMSE was included, but was insignificant (p=0.915).

Various stepwise procedures were tested and all indicated results similar to those above, with gender and MMSE being the best set of predictor variables. While this may provide a means of identifying those at high risk of death following their fracture, there are no interventions to alter dementia or gender. All of these variables are pre-fracture variables, which makes any intervention difficult. From the univariate analysis, the variable that is significantly related to mortality and seemingly most amenable to intervention would be function. However, the fact remains that in the presence of gender and mental status, changing function was not shown to have a significant impact.

4.3 PREDICTING INSTITUTIONALIZATION

As discussed in section 2.10, some research has been done to examine risk of institutionalization in relation to a number of risk factors. These risk factors have included demographic characteristics (age, gender, education, and income) as well as pre-fracture and post-fracture variables (social support, health perception, function, and number of comorbidities). This analysis attempts to examine these risk factors as a group and identify those that increase the risk of institutionalization three months post-fracture. The study objectives identified two groups of risk factors of interest: 1) those present at the time of admission to the hospital with a hip fracture, to identify those patients (upon admission) who were at high risk of institutionalization; and 2) all variables, to identify possible interventions that could be implemented after discharge to lessen the risk of institutionalization.

4.3.1 Description of Sample

This sample of 338 patients included survivors (three months post-fracture) living in the community at the time of their hip fracture. In addition to the basic demographic information in Table 4.1 (Section 4.0), 219 (65%) of these were patient interviews. Three quarters of these respondents had fewer than four comorbidities and the average score on the MMSE was 23 out of 30.

While all of these respondents were living in the community before their fracture, fifty-eight (17%) of these were in long term care (institutionalized) three months after their fracture. Table 4.8 compares selected characteristics of those institutionalized with those remaining in the community. Almost half (45%) of this institutionalized group were over the age of 85 while more than three quarters (78%) of the community-dwelling (non-institutionalized) group was under age 85. The institutionalized group was sicker than the non-institutionalized group, with over two thirds of them (69%) having three or more comorbidities while almost two thirds (62%) of the community-dwellers had fewer than three comorbidities. Mental functioning was also lower in the institutionalized group, with the average MMSE score being 16 for this group and 24 for those living in the community.

Table 4.8 Selected Characteristics by Outcome

OUTCOME	Average Age (s.d.) n=331	Average Number of Comorbidities (s.d.) n=338	Average MMSE Score (s.d.) n=304	Male (%) n=338
Institutionalized	84.2 (6.4)	3.2 (1.5)	16 (6.5)	10 (17)
Community	79.4 (7.1)	2.2 (1.7)	24 (8.5)	65 (23)

Compared to the non-institutionalized group, the institutionalized group was an average of ten points lower in pre-fracture function, and thirty points lower in post-fracture function (Table 4.9). Compared to pre-fracture function, the average functional score was 10% lower for the non-institutionalized and 35% lower for the institutionalized group three months after the hip fracture. In addition to the pre-fracture and post-fracture functional scores, another functional score was collected during the week following the hip fracture. It is interesting to note that by one week post-fracture, both groups had experienced functional decreases of approximately 50% from their pre-fracture state. The non-institutionalized group had regained much more of their function by three months than the institutionalized group.

4.3.2 Bivariate Analysis

The dependent variable for this analysis was "institutionalized at three months". This is a dichotomous variable with 0 meaning "not institutionalized" and 1 meaning "institutionalized". The independent variables are listed in the Table 4.10.

There were no indications that there may be estimation problems resulting from highly correlated independent variables (please see section 3.10.3.5 for clarification), the highest correlation being between mental status and post-fracture function (0.61). From the univariate logistic regressions, the risk of institutionalization increases with increasing age and comorbidities, female gender, and poorer pre-fracture and post-fracture health perception (Table 4.10). The risk of institutionalization decreases with increases in mental and physical functioning and increased post-fracture social support (Table 4.10).

Table 4.9 Health and Social Support by Outcome

OUTCOME	Average Pre* Barthel Score (s.d.) n=338	Average Post** Barthel Score (s.d.) n=338	Number of Patients with Good to Excellent Pre* Health Perception (%) n=338	Number of Patients with Good to Excellent Post** Health Perception (%) n=327	Number of Patients Having Post** Social Support (%) n=331
Institutionalized	84.4 (15.4)	52.7 (24.3)	36 (62)	21 (39)	41 (71)
Community	93.8 (13.9)	85 (20.5)	210 (75)	187 (68.5)	235 (86)

*Note: Pre is abbreviation for pre-fracture
**Note: Post is abbreviation for post-fracture

4.3.3 Multivariate Analysis

Any variables having a p-value greater than .25 in the bivariate analysis could be considered for removal from the multivariate analysis (Hosmer and Lemeshow). This would result in the exclusion of gender (p-value of .32), occupational prestige (p-value of .68) and pre-fracture social support (p-value of .85). Based on the results of the preceding (mortality) analysis, where the effect of gender doubled when adjusted for occupational prestige and education, a decision was made to include gender and occupational prestige in the multivariate analysis. It could be that gender may become significant in the presence of other independent variables (such as occupational prestige and education). Therefore, only pre-fracture social support was removed.

Table 4.10 Logistic Regression Results to Predict Institutionalization *

Variable	**Univariate Logistic**		**Multivariate Logistic**			
			Pre-fracture variables only		**Pre and post-fracture variables**	
	OR	**95% C.I.****	**OR**	**95% C.I.****	**OR**	**95% C.I.****
Age	1.1	1.06, 1.16	1.15	1.08, 1.23	1.17	1.08, 1.27
Male Gender	0.69	0.33, 1.44	0.44	0.16, 1.25	0.27	0.07, 0.99
Occupational Prestige	0.99	0.93, 1.05	1.03	0.95, 1.12	1.05	0.96, 1.16
Education	0.85	0.69, 1.03	1.05	0.83, 1.35	0.99	0.74, 1.34
Comorbidity	1.38	1.18, 1.62	1.1	0.87, 1.41	1.1	0.82, 1.48
MMSE	0.97	0.95, 0.98	0.97	0.96, 0.99	0.99	0.97, 1.01
Pre Social Support	1.04	0.71, 1.51	Not included		Not included	
Pre Health Perception	1.38	1.05, 1.82	1.3	0.89, 1.92	1.1	0.7, 1.84
Pre Function	0.97	0.95, 0.98	0.99	0.97, 1.02	1.02	0.98, 1.05
Post Social Support	0.64	0.45, 0.91	Not included		0.76	0.44, 1.31
Post Health Perception	1.89	1.36, 2.63	Not included		1.1	0.67, 1.85
Post Function	0.95	0.94, 0.97	Not included		0.95	0.93, 0.97

*Note: Pre is an abbreviation for pre-fracture and post is an abbreviation for post-fracture

4.3.4 Significant Pre-fracture Variables

One of the objectives of this study was to examine whether there were variables, identifiable at the time of hospital admission, that would predict those at high risk of institutionalization. By excluding the three post-fracture variables (social support, health perception, and function), age (OR=1.17, p=0.00) and mental status (OR=.97,p=0.00) were the two variables predictive of institutionalization (Table 4.10). These results indicated that at the time of admission to the hospital with a hip fracture, older patients or those with lower mental functioning were at increased risk of institutionalization.

Both age and mental status were continuous variables and therefore the assumption of linearity in the logit should be checked at this point. Recall (section 3.10.3.5) that the Box-Tidwell transformation would be useful for this purpose. This procedure involved including the extra variable (age[ln(age)]) in the model containing mental status and age. This process yielded an insignificant coefficient (p-value of 0.4), providing evidence of age (as continuous) being linear in the logit.

While age was kept as continuous, there was evidence to indicate nonlinearity of mental status in the logit. When x[ln(x)] was included in the model (x representing mental status), the coefficient of this variable was significant (p-value of .006). This sample consisted of those living in the community before fracture and therefore having high mental functioning. This is likely the reason for the difference in linearity of mental status in this analysis compared to the mortality analysis. To address this issue it is useful to consider another procedure advocated by Hosmer and Lemeshow. They suggest dividing mental status into quartiles and using three dummy variables (representing the quartiles) in place of mental status in the model. This can give some idea as to whether the relationship between mental status and the logit is linear or some other form.

Applying this procedure, the quartiles of mental status were identified as 20, 25, and 28. This meant that 25% of MMSE scores were 20 or below, 50% of MMSE scores were 25 or below, and 75% of MMSE scores were 28 or below. In place of mental status, the three indicator variables were included in the model, with the lowest quartile of mental status used as the reference group. This yielded the results in table 4.11. This table indicates that, compared to those with MMSE scores of 20 or less (quartile 1), those with higher MMSE scores (quartiles 2 – 4) had significantly reduced risk of institutionalization

(0.17, 0.03, 0.17 respectively). While the odds ratio for quartile 3 is somewhat smaller than that of quartile 2 or quartile 4, the odds ratios for all three quartiles are similar and reveal a significantly reduced risk as compared to quartile 1. Hosmer and Lemeshow suggest this provides evidence for dichotomizing mental status by creating a variable assigned a value of one for quartile 1, because risk was higher in this quartile relative to quartiles 2 through 4. Therefore, mental status was dichotomized into low (MMSE score of 20 or less) and high (MMSE score of 20 or more). Results are summarized in Table 4.12.

Table 4.11 Categorization of Mental Status

Variable	Odds Ratio	95% C.I.*	Sample Size
Age	1.11	1.05, 1.17	302
Quartile 1	1.0		74
Quartile 2	0.17	0.07, 0.43	76
Quartile 3	0.03	0.003, 0.2	76
Quartile 4	0.17	0.07, 0.43	76

*Note: C.I. is an abbreviation for confidence interval.

Table 4.12 Pre-fracture Variables Predicting Institutionalization

Variable	Odds Ratio	95% C.I.*	Sample Size
Age	1.1	1.05, 1.17	302
Low Mental Status	8.1	3.9, 15.9	76

*Note: C.I. is an abbreviation for confidence interval

The resulting equation for predicting institutionalization (based on listwise deletion of missing values for the variables in the model) from information available at the time of admission is:

$$\ln(p/(1-p)) = -11 + .1(\text{age}) + 2.09(\text{MMSEGRP})$$

$$\text{where MMSEGRP } \begin{array}{l} =1 \text{ if low} \\ =0 \text{ if high} \end{array}$$

These results indicate that, for two patients of the same age but with different mental function, the patient with low mental functioning had 8 times the risk of being institutionalized in three months compared to the patient with high mental functioning.

The increased risk of institutionalization resulting from an additional ten years in age can also be calculated from this equation as $e^{(10^{*}.1)} = e^{(1)}$ or 2.78. This indicates that for two patients of the same mental functioning, risk of institutionalization is almost tripled for every additional ten years in age.

The estimated amount of variation in institutionalization explained by the model is:

$$R_L^2 = \frac{-2\log L_0 - (-2\log L_1)}{-2\log L_0} = \frac{261.14-202.18}{261.14} = .23$$

Approximately 23% of the variation in the model containing only the intercept term is explained by the model including mental status and age. Therefore, institutionalization risk is not well explained by information present at the time of admission. The following analysis examines whether there are post-fracture variables that also contribute to the explanation of institutionalization risk.

4.3.5 The Best Model to Predict Institutionalization

In addition to those variables observable at the time of admission, there may be some post-fracture variables that increase the risk of institutionalization. While in some instances, the three month measures were taken after a respondent had been institutionalized, the three month measures will be used as the best estimates of these measures at the time of institutionalization. For example, a patient may be institutionalized one month after fracture, however function at three months will be used to estimate function at the time of institutionalization. If there is any difference in these two measures, it is likely that function one month after fracture will be lower than function at three months post-fracture. In this case, function at three months will overestimate (be larger than) function at the time of institutionalization. These were the best estimates available of these important measures, and if they were biased, bias would occur in the direction of overestimating the measures of interest. For instance, if post-fracture function was estimated to be important, it would also be important if the true measures were known.

For this analysis involving all the variables, the post-fracture variables (social support, health perception, and function) were considered in addition to the pre-fracture variables examined in the previous analysis. Because all of the post-fracture variables had bivariate p-values less than .25 (Table 4.10), all the variables except pre-fracture social support were considered for inclusion in the model . The multivariate analysis results (Table 4.10) show that, holding other independent variables constant, there is an increased risk of institutionalization as age increases or post-fracture function decreases. The risk is almost four times as high for females (Table 4.13). Several of the variables that were significant in the univariate analysis became insignificant and changed their direction of effect in the multivariate analysis, as a result of correlations among the independent variables.

Table 4.13 Number Institutionalized by Gender and Age

GENDER	AGEGROUP 65-75 (%)	75-85 (%)	85+ (%)	TOTAL (%)
Female	4 (9)	21 (45)	22 (47)	47 (82)
Male	1 (10)	5 (50)	4 (40)	10 (18)

Of the three variables that remained significant, the coefficients of age and post-fracture function remained consistent between the bivariate and multivariate regression while the coefficient of gender was halved. The change in the coefficient of gender indicated there were other independent variables that were important to include to adjust its effect. Gender was correlated with occupational prestige, with the majority of females employed as either housewives (34%) or clerical workers, (15%) while males were likely to be foremen, managers, or professionals (50%). Gender was also associated with mental status, with males having poorer mental function than females (MMSE scores of 21 and 23 respectively). In the multivariate analysis, occupational prestige and mental status were held constant. However, when the multiple regression was done excluding occupational prestige and mental status, and these two variables were not controlled for, the coefficient of gender was much closer to its bivariate value (.49), and gender also became insignificant (p=0.18). Therefore, age (p-value of 0.00), gender (p-value of 0.05), and post-fracture function (p-value of 0.01) were significantly related to institutionalization and were kept in the model along with mental status (p-value of 0.23) and prestige (p-value of 0.29) to adjust the effect of gender.

The assumption of a linear relationship between post-fracture function (a continuous variable) and the logit can be checked at this point. Using the Box-Tidwell transformation (please see Section 4.2.3 for clarification), the coefficient of xln(x) (where x is post-fracture function) was significant (p-value of 0.00). This provides evidence of nonlinearity of post-fracture function in the logit. The distribution of post-fracture function was skewed, with only 25% of respondents having Barthel scores of 70 or less (out of 100), while 50% had scores of 90 or more, and 26% had perfect scores. It seemed reasonable to categorize post-fracture function as low (Barthel score of 70 or less), medium (Barthel score of 70 to 90) and high (Barthel score over 90). When post-fracture function was categorized in this way, the coefficient of mental status became significant (p-value of .02) while the coefficient of gender became insignificant (p-value of .1). Therefore, both gender and occupational prestige (included in the model to adjust the effect of gender), were removed from the model.

The variables left in the model included age, mental status, and post-fracture function. Checking the linearity assumption pertaining to age and mental status, the results were analogous to those of section 4.3.4. Therefore, age was kept as a continuous variable in the model while mental status was dichotomized as low (MMSE of 20 or less) or high (MMSE of 20 or more). Please see section 4.3.4 for further discussion of age and mental status. The results are summarized in Table 4.14.

Table 4.14 Pre-fracture and Post-fracture Predictors of Institutionalization *

Variable	Odds Ratio	95% C.I.*	Total
Age	1.09	1.03, 1.16	302
Low post function (compared to high function)	26.1	5.7, 118.1	92
Medium post function (compared to high function)	5.3	1.1, 26	78
Low mental status	3.6	1.5, 7.5	76

*Note: post is an abbreviation for post-fracture

To find the best predictive model, interaction terms between age and the other variables were included, but all of these terms were insignificant (all p-values were above 0.1).

A number of stepwise modeling procedures were also tried (using both forward selection and backward elimination procedures). Of the independent variables, the three significant variables continued to be age, mental status, and post-fracture functional score.

The best predictive model (based on listwise deletion of missing values for the following variables) including all pre-fracture and post-fracture variables was:

$$\ln(p/(1-p)) = -11.27 + 1.29(x_1) + .09(x_2) + 3.3(x_3) + 1.7(x_4)$$

where: x_1= 1 if low mental status
0 if high mental status

x_2= age in years

x_3= 1 if low post-fracture function (Barthel score of 70 or less)
0 if medium or high post-fracture function (Barthel score of 90 or more)

x_4=1 if medium post-fracture function (Barthel score of 70 to 90)
0 if low or high post-fracture function

This model indicates that, for two individuals of the same age and post-fracture function but differing mental status, the individual with low mental status is at approximately four times (OR of 3.6) the risk of institutionalization as the individual with high mental status. Also, every eight additional years of age doubles the risk of institutionalization in individuals of the same mental status and post-fracture function.

This was not a practical model to use for predictive purposes unless a good estimate of post-fracture function could be calculated from knowledge of the pre-fracture information.

Perhaps this analysis does indicate that interventions aimed at improving post-fracture function could decrease risk of institutionalization. For example, this analysis suggests that an individual with low post-fracture function is 26 times as likely to be institutionalized as an individual of the same age and mental status with high post-fracture function. In addition, an individual with post-fracture function in the medium range has five times the risk of institutionalization as an individual with high post-fracture function.

The amount of variation in institutionalization explained by the model is estimated by:

$$R_L^2 = \frac{-2\log L_0 - (-2\log L_1)}{-2\log L_0} = \frac{261.14 - 167.07}{261.14} = .36$$

Therefore, approximately 36% of the variation in the model containing only the intercept term is explained by the model that also includes mental status, age, and post-fracture function ($R_L^2 = .36$). This implies that important variables have not been included in the analysis, although these specific variables were chosen because they have been found to be significantly related to institutionalization in other studies. There are still several personal variables that have not been widely studied but could be important in relation to institutionalization. These would include characteristics such as determination and resourcefulness, as well as family variables such as burden, stress, and finances. Medical variables such as complications following surgery also need to be considered.

The previous analysis using only the pre-fracture variables indicated that for two individuals of the same age but different mental status, the respondent with low mental status had 8 times the risk of institutionalization as the patient with high mental status. This analysis using all the variables (pre-fracture and post-fracture) implied that if these individuals also had the same post-fracture function, the individual with low mental status had 4 times the risk of institutionalization of the respondent with high mental status. Therefore, by intervening to increase post-fracture physical function, the risk of institutionalization can be significantly reduced.

CHAPTER 5

HEALTH PERCEPTION

MULTIPLE LINEAR REGRESSION

LISREL MODEL

5.0 HEALTH PERCEPTION

The concept of health perception is a more subjective outcome than mortality or institutionalization, and has received much less study. The risk factors for poor health perception following a hip fracture have not been identified. Because the risk factors examined in this analysis have not been identified in previous studies, some discussion is warranted pertaining to the choice of risk factors to be studied. The following is a discussion about the meaning of health perception, and how it is thought to be influenced. In addition to justifying the choice of the risk factors examined, this may be of benefit in interpreting the results of this analysis and the ensuing LISREL analysis.

The World Health Organization defines health as a "state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (WHO). Lawton hypothesized four dimensions to quality of life: behavioural competence, perceived quality of life, psychological well-being, and objective environment (Lawton). Health is concerned with the first two dimensions. Behavioural competence is the objective measure of health and its subjective counterpart is perceived quality of life.

Health perception is part of the perceived quality of life dimension. This dimension is comprised of the individual's subjective assessment of his/her competence in the physical, mental, and social functioning domains.

The multidimensional scales that measure health, such as the SF-12, measure an individual's capability in the domains of physical, mental, and social functioning. It is well recognized that any attempt to account for health, specifically the subjective component of health (health perception), must include these three domains. Therefore, in explaining health perception, the subsequent analyses focus on these three domains.

5.1 MULTIPLE REGRESSION TO PREDICT HEALTH PERCEPTION

Health perception following hip fracture has not been studied. Risk factors included in this analysis were determined based on previous research underlying health perception in general. These risk factors include demographic characteristics as well as pre-fracture and post-fracture variables (social support, pre-fracture health perception, function, and number of comorbidities). This analysis attempts to identify which of these variables, as a group, improves health perception three months after a hip fracture.

5.1.1 Description of Sample

Excluding those patients with missing values for MMSE, 367 respondents with completed baseline and three month interviews were included. The 56 excluded respondents made up 17% of all proxy interviews. Reasons for doing a proxy interview among these 56 included: 9 (16%) with low mental status, 32 (57%) could not speak English, and 4 (7%) were deaf. The remaining 11 (20%) proxies were interviewed for various reasons such as the patient refused to do a MMSE, the patient was unresponsive, or the patient was missed in the hospital. It is possible that, with the exception of the 9 patients with low mental status, there were two distinct groups of proxy interviews: 1) those done because of the patient's low mental status; and 2) those done for other reasons (primarily the inability of the patient to speak English). In the first case MMSE scores will be available, while in the second case MMSE scores will be missing. Therefore, these 56 patients were excluded from all of the following calculations and analysis.

In addition to the demographic information in Table 4.1 in section 4.0, approximately 60% (222) of this group comprised patient interviews. Three quarters (72%) of these respondents had fewer than four comorbidities, and the average score on the MMSE was 20 out of 30.

There was a noticeable shift in health perception between the pre-fracture and post-fracture time period. Eight percent of respondents rated their pre-fracture health as excellent while only four percent rated their post-fracture health as excellent. Almost forty percent in each time period rated their health as good. The proportion of respondents rating their health as fair or poor increased from 30% (pre-fracture) to 38% (post-fracture).

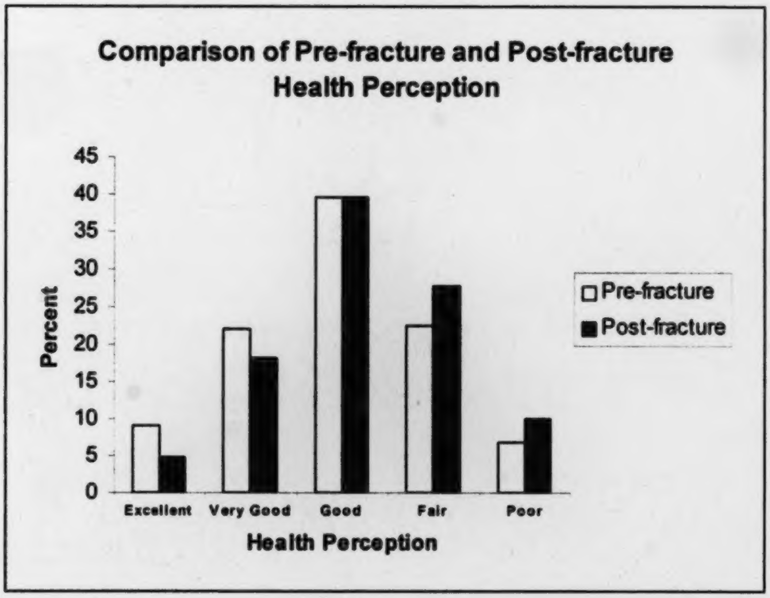

FIGURE 3 COMPARISON OF HEALTH PERCEPTION

There was very little change in social support over the three-month period, with approximately 80% of respondents feeling that they had someone to help them if they needed it. There was, however, an average drop of 15 points (from 88 to 73) in function score between the two time periods.

5.1.2 Bivariate Analysis

The dependent variable for this analysis was a rating of health perception on a scale from 1 (excellent) to 5 (poor). Please see section 3.4.2 for further discussion of this variable. The validity of this measure is discussed in Section 5.2.4.

None of the correlations among the variables used in this analysis exceeded 0.7. The highest correlation (0.69) was between MMSE and post-fracture function, with better mental functioning being related to higher function at three months. However multicollinearity can still cause a problem even in the presence of moderately large correlations such as these. Therefore, an examination of the VIF's is recommended (Fox) and is discussed below.

Individually, post-fracture health perception was related to all the independent variables except pre-fracture social support. Increases in age and number of comorbidities were associated with decreases in health perception three months after fracture. Increases in education, occupational prestige and mental status were affiliated with increases in post-fracture health perception. Increases in post-fracture health perception also accompanied increases in pre-fracture and post-fracture function, pre-fracture health perception, and post-fracture social support. Also, the larger the discrepancy between functioning before and after fracture (goal) then the lower the health perception (please see section 3.6 for further clarification of the goal variable).

5.1.3 Multiple Linear Regression Analysis

With post-fracture health perception as the dependent variable, the model of health perception (Figure 4) indicates that all the independent variables will be entered into the model. This is corroborated by the fact that all the independent variables had bivariate p-values less than 0.25 (based on calculated t-statistics). This is a discrete dependent variable and therefore poses challenges when performing a multiple regression analysis (please see Section 3.10.2.7 for further elaboration). Examination of the VIF's (please see section 3.10.2.6 for discussion of VIF) indicated that there was a multicollinearity problem involving goal, pre-fracture function and post-fracture function (all three variables having VIF's above 14). This was not surprising because goal was calculated from pre-fracture and post-fracture function. When goal was not included in the analysis there were no apparent multicollinearity problems. Therefore, the goal variable was removed from the analysis.

Table 5.1 Linear Regression Results to Predict Post-Health Perception *

Variable	**Simple Linear Regression**		**Multiple Linear Regression**	
	Coefficient	**95% C.I.****	**Coefficient**	**95% C.I.****
Age	0.018	0.003, 0.032	0.00	-0.015, 0.014
Occupational Prestige	-0.02	-0.046, -.003	-0.02	-0.044, 0.002
Education	-0.08	-0.149, -.017	0.01	-0.06, 0.08
Comorbidity	0.18	0.121, 0.236	0.1	0.035, 0.17
MMSE	-0.01	-0.012, -0.05	0.00	-0.004, 0.006
Pre Social Support	-0.09	-0.222, 0.039	0.01	-0.125, 0.143
Pre Health Perception	0.33	0.24, 0.43	0.2	0.09, 0.304
Pre Function	-0.014	-0.02, -0.009	0.01	-0.002, 0.014
Post Social Support	-0.29	-0.426, -0.158	-0.13	-0.279, 0.01
Goal	0.017	0.012, 0.022	Not included	
Post Function	-0.014	-0.17, -0.01	-0.01	-0.018, -0.007

*Note:Pre is an abbreviation for pre-fracture and post is an abbreviation for post-fracture
**Note: C.I. is an abbreviation for confidence interval.

While most of the variables were significantly related to health perception in the bivariate analysis (Table 5.1), only three variables were significant at the 0.05 level (pre-fracture health perception, number of comorbidities, and post-fracture function) and two variables were significant at the 0.07 level (occupational prestige and post-fracture social support) in the multivariate analysis. Therefore these five variables were candidates for further consideration. The coefficients of these five variables were all very small and did not exhibit large changes in the multivariate as compared to the bivariate analysis. Prior to regressing health perception on these five variables, the assumption that each of the independent variables is linearly related to health perception should be checked. For a continuous dependent variable, this involved plotting the dependent versus each of the independent variables. However, health perception is a discrete variable and therefore a table might be more useful in determining a linear trend.

Table 5.1 depicts the relationship between health perception and the independent variables. The fact that health perception is reverse coded (1 is excellent to 5 representing poor) should be kept in mind when interpreting the results. There is a positive relationship between the two health perception variables, and an increase in pre-fracture health perception is associated with an increase in post-fracture health perception. Generally, Table 5.2 depicts a negative relationship (an increase in the independent variable being correlated with a decrease in the dependent variable) between health perception and three of the independent variables (occupational prestige, post-fracture social support, and post-fracture function). An increase in the number of comorbidities, however, is associated with an increase in health perception. Examining Table 5.2, there is no reason to suspect there is not a linear relationship between health perception and each of the independent variables. Therefore, all five variables were considered in the multivariate model.

Table 5.2 Relationship Between Health Perception and its Predictors

Post-fracture Health Perception	**Average Occupational Prestige Score (s.d.) n=347**	**Average Number of Comorbidities (s.d.) n=354**	**Average Pre-fracture Health Perception (s.d.) n=354**	**Average Post-fracture Social Support (s.d.) n=351**	**Average Post-fracture Function (s.d.) n=354**
Excellent	8.8 (5.8)	1.9 (1.8)	2.4 (1.2)	3.0 (0.0)	91.5 (13.1)
Very Good	7.7 (4.7)	1.9 (1.6)	2.4 (0.9)	2.8 (0.5)	87.9 (18.6)
Good	7.6 (4.8)	2.2 (1.6)	2.9 (0.9)	2.6 (0.8)	77.8 (25.6)
Fair	7.4 (4.9)	2.9 (1.7)	3.3 (1.0)	2.6 (0.8)	64.4 (31.5)
Poor	5.4 (4.4)	3.8 (1.6)	3.5 (0.9)	2.2 (0.9)	50.3 (32.5)

The results of the multivariate analysis of health perception and the five independent variables are summarized in Table 5.3. The coefficients confirm the relationships reflected in Table 5.2. For example, increases in occupational prestige, post-fracture social support, pre-fracture health perception, and post-fracture function are correlated with increases in health perception. Additional comorbidities are associated with decreased health perception. Unfortunately the signs of the coefficients are confusing because of the coding of health perception.

Table 5.3 Predictors of Health Perception

Variable	**Coefficient (s.e.)**	**p-value**
Occupational Prestige	-0.02 (0.009)	0.04
Number of Comorbidities	0.08 (0.03)	0.01
Pre-fracture Health Perception	0.2 (0.05)	0.00
Post-fracture Social Support	-0.13 (0.06)	0.04
Post-fracture Function	-0.01 (0.002)	0.00

5.1.3.1. REGRESSION DIAGNOSTICS

Checking the assumptions of the regression model yielded the following results:

Multicollinearity: the small standard errors of the coefficients provide evidence that there is no colinearity problems among the independent variables. This is further supported by the VIF's (please see section 3.10.2.6) which are all 1.2 or less.

Normality of the error terms: as previously discussed in section 3.10.2.6, with an ordinal dependent variable, the error terms will not be normally distributed. This is not a problem as long as there is a reasonable amount of spread in the data. The two variables that had sparse data in some categories were education and number of comorbidities. Education had few observations in the lowest and highest categories while few people had a large number of comorbidities. The two lower education categories were combined, as were the two upper education categories. A regression was then done using this variable in place of the original education variable. This made no difference in the regression results and therefore education was left in its original form. The same procedure was done with the comorbidities variable by grouping those patients having seven or more comorbidities together. Again this made no difference to the regression results.

Heteroscedasticity: nonconstant error variance is a concern in this analysis, indicating another form of analysis (perhaps ordinal logistic regression or logistic regression) may be more appropriate for this data. Examination of the various residual plots (please see residuals plots, Appendix 12), constructed with the residuals resulting from the multiple regression, indicates the error variance may not be constant in any of the plots. Upon visual examination of the residual plots, none of the variables are judged to have categories for which the spread of the error terms is three times the spread of the error terms in other categories. However, the variances do not appear to differ by a factor of three or more, and therefore will be left alone (please see section 3.10.2.6 for clarification of this assertion).

5.1.4 Prediction of Post-fracture Health Perception

At the .05 level of significance the fitted regression equation is as follows:

Post-fracture health perception= $3.58-.021(X_1)+.103(X_2)+.197(X_3)-.13(X_4)-.01(X_5)$

Where:

X_1: occupational prestige
X_2: number of comorbidities
X_3: pre-fracture health perception
X_4: post-fracture social support
X_5: post-fracture function

In practical terms, the coefficient for number of comorbidities indicates that for each additional increase in number of comorbidities, health perception increases an average of .103 units, all other independent variables held constant.

Keeping in mind health perception was reverse coded, the regression equation indicates that increases in health perception three months after fracture were related to higher occupational prestige, post-fracture social support, pre-fracture health perception, and post-fracture function. Fewer comorbidities were also related to increased post-fracture health perception.

While several of the variables were related to health perception in the simple linear regression, they became insignificant in the multiple regression. They also showed marked changes in coefficients and, in many cases, sign. This could indicate that these variables do not influence health perception directly, but they may have an indirect influence via variables not in the equation, and the indirect effects are not being captured in the regression analysis. As depicted in the original LISREL model (Figure 4) , several indirect effects are postulated, in addition to many direct effects. For example, the LISREL model hypothesizes that pre-fracture function influences post-fracture function and pre-fracture health perception, both of which in turn influence post-fracture health perception. There are no direct influences of pre-fracture function on post-fracture health perception. The multiple regression results show that when controlling for pre-fracture health perception and post-fracture function, there is no relationship between pre-fracture function and post-fracture health perception, which would be consistent with the LISREL model.

This analysis also indicates that, while there are several variables significantly related to health perception, only 26% of the variation in health perception is explained by the model. Referring to section 3.10.2.4., measurement error in the variables may explain the low R-square value. Whenever measurement error is suspected, it can be adjusted for in the LISREL analysis.

5.2 THE LISREL MODEL OF POST-FRACTURE HEALTH PERCEPTION

As in the previous multiple linear regression analysis, the original LISREL model (Figure 4) uses the same variables in attempting to explain health perception three months after hip fracture. Recall from the preceding regression analysis that it was felt that the addition of indirect effects and the adjustment for measurement error may improve the explanation of health perception. Therefore, indirect effects have been added into the LISREL model and adjustment for measurement error can be made. In adjusting for measurement error, remember that there are two groups of respondents (proxies and patients). Because the proxies were answering the questions for the patients (who cannot answer for themselves), the proxy responses were expected to have more measurement error than the patient responses. This divided the respondents into two groups (patient and proxy), with the patient group being analyzed separately from the proxy group because it contained less measurement error.

5.2.1 Overview

An outline of the steps involved in the development of the final model are as follows. The original (basic) model (Figure 4) was developed based on existing theory and research. To reduce bias in the estimated effects, the error variances were fixed. The data were entered into the LISREL program in the form of a pairwise covariance matrix[3] (please see section 3.10.3.2 for further discussion of the covariance matrix). The model was then tested on the patient group and, based on the goodness of fit diagnostics, the model was revised to provide a better fit between the data and the model. This process was then repeated with the proxy group. This resulted in two models, one for the patient data (patient model) and one for the proxy data (proxy model). A sensitivity analysis was then done to check the reasonableness of the assumptions made in constraining the measurement error variances. A final analysis was conducted to test the multiple indicator model. A more detailed discussion is provided in succeeding sections of this chapter.

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[3] For this data, calculation of the listwise covariances would have resulted in the omission of 45 (12%) cases since this was the number of cases with at least one missing value. In the interest of using all available information, pairwise covariance matrices were used for these LISREL runs.

5.2.2 The Variables

As in the preceding regression analysis, it was hypothesized that health perception was influenced by the three domains of social, physical, and mental functioning. The following variables were considered to be important influences on health perception (Table 5.4).

Table 5.4 Description of Variables

Eta	Concept	Indicator
η_1	Age	Reported Age
η_2	Income	Occupational Prestige
η_3	Education	Level of Education
η_4	Comorbidities	Number of Comorbidities
η_5	Dementia	MMSE
η_6	Pre-fracture Social Support	If sick, anyone to help you
η_7	Pre-fracture Health Perception	How do you think your health is (Where is your health on a scale from 0-100)**
η_8	Pre-fracture Function	Pre-fracture Barthel score
η_9	Goal*	Constructed from pre and post function, so no direct indicator
η_{10}	Post-fracture Social Support	If sick, anyone to help you
η_{11}	Post-fracture Health Perception	How do you think your health is (Where is your health on a scale from 0-100)**
η_{12}	Post-fracture Function	Post-fracture Barthel score

*Note: goal = post-fracture function – pre-fracture function.

**Note: this is the second indicator of health perception for the multiple indicator model.

5.2.3 The Basic Model of Health Perception

Because of the complexity of the postulated system of direct and indirect effects, the theoretical underpinnings of the causal mechanisms underlying the model will be elaborated upon below. Please refer to Figure 4 during the ensuing discussion. The basic model hypothesizes that increasing age, with associated cell death and neuron loss, causes dementia. Dementia, in turn, is hypothesized to cause a decrease in social support by leading to personality changes and interfering with interpersonal communication. Demented individuals also lose the ability to maintain a healthy lifestyle, therefore leading to lower pre-fracture function.

Pre-fracture function responds to several items which influence physical health. For example, aging causes physiological deterioration which leads to poorer health and lower function. A decrease in health and function also results from additional comorbidities. While age and illness act upon function at a very basic biological level, the effects of social support are more subtle. Less social support can lower function in a couple of ways. Respondents lacking social support may not have anyone to assist them in getting to medical appointments, shopping, and generally help them with whatever is necessary to maintain health (an instrumental pathway). Decreased social support can also cause an individual to become depressed and isolated, with a resultant loss of interest in preserving health. Therefore, social support can influence function either in a concrete and instrumental manner or through a less tangible, psychological pathway. This psychological pathway is likewise the mode of influence of income and education. Higher income and more education are hypothesized to increase self-esteem which results in increased health-promoting behaviour and therefore higher function.

The following variables negatively influence pre-fracture health perception by causing negative feelings. In order of anticipated importance (based on theory), lower pre-fracture health perception results from: 1) dementia; 2) decreasing function; 3) additional comorbidities; 4) aging; and 5) less social support. Dementia leads to an inability to participate in meaningful activities and thus an inability to use time and plan effectively. The inability to use time and plan effectively results in feelings of losing control over other aspects of life, including health, and may lower health perception. Feelings of losing control over health is hypothesized to decrease health perception through several other pathways as well. Feelings of loss of control over health result from additional comorbidities and/or a decrease in function (ability for self-care). Similarly, aging tends to be thought of as a disease (comorbidity) in our society and as such leads to lower health perception. While the physical manifestations of deteriorating health (more illness and poorer function) cause feelings of loss of control over health, less social support affects health perception by causing feelings of isolation, loneliness, depression, and a general sense of lack of ability to manage. Conversely, as health perception can be negatively influenced by variables causing negative feelings, it can be positively influenced by variables causing positive feelings. Higher mental functioning permits patients to utilize time and plan effectively. This results in a sense of being in control which improves self-esteem and raises health perception. It is known that the effects of aging are not chronological. Aging persons who develop minimal functional disabilities, and few comorbidities maintain a greater sense of self-esteem and a higher perception of health. A good social support network allows a person to exact more control over most aspects of life and promotes greater self-esteem. This in turn leads to more interest in maintaining an active, involved and healthy lifestyle, thus increasing health perception.

Positive feelings such as high self-esteem can increase health perception. Self-esteem is higher for those with more education. These individuals are more likely to choose health-promoting lifestyles because these people have a personality that is motivated by the idea of investing now for future benefit. Increased self-esteem is also associated with having more income. Higher income increases self-esteem which encourages health-inducing behaviours.

Higher income also allows for access to more options in maintaining independence, thus increasing the ability to exert control over health. Therefore, higher income is accompanied by increased health perception.

Post-fracture social support will respond to pre-fracture social support and dementia. Dementia leads to decreased post-fracture social support by adding to caregiver stress. After a hip fracture the caregiver has someone to care for who, in addition to having declining mental function, poses an even greater burden because of the physical disability associated with a broken hip. This stress may be too great and may lead to the caregiver abandoning this role, and seeking institutional care as the solution.

The forces acting on post-fracture function include pre-fracture function, dementia, and post-fracture social support. Dementia interferes with rehabilitation and recovery as the patient loses the ability to receive instructions and take care of himself/herself. In addition to dementia, post-fracture function is also decreased by having less post-fracture social support. Less social support following hip fracture can lead to feelings of isolation, depression, and loss of interest in preserving health. Social support can also influence function in a more instrumental fashion. The availability of social support will enhance post-fracture functioning by ensuring that the patient will have someone to help him/her get to medical appointments, do shopping and banking, and assist with other necessities important in carrying out daily activities.

It is theorized that there will be the same influences on post-fracture health perception as on pre-fracture health perception, but perhaps these influences will be magnified by the hip fracture. For example, feelings of losing control over health that resulted from having additional comorbidities will be heightened by the hip fracture, further reducing post-fracture health perception. On the other hand, higher income and functional recovery (as measured by the goal variable) will act to increase post-fracture health perception (please see section 3.6 for clarification of the goal variable). Higher income will lead to increased feelings of control and independence, by enabling an individual to access the services necessary for recovery. The goal variable will increase health perception by resulting in feelings of encouragement as an individual sees his/her function returning to its pre-fracture level (goal is decreasing). The mechanisms through which dementia, post-fracture social support and post-fracture function influence post-fracture health perception are similar to the corresponding effects in the pre-fracture period.

In summary, the model in Figure 4 depicts the anticipation that an individual's health three months after fracture will be influenced by his/her mental, social, and physical functioning both before and after fracture. Changes in these domains will be relayed via subjective means (feelings) into changes in the subjective component of health (health perception). The objective counterpart (function) will be influenced by the physical health component.

5.2.4 The Error Variances

Fixing the error variances makes a statement as to the reliability of the measurement, because the smaller the proportion of variation attributable to error, the more accurately the indicator measures the concept. Setting the error variances also addresses the issue of validity of the measurement because the amount of variation attributable to error reflects the accuracy with which the indicator is capturing the meaning of the concept. In other words, the indicator is measuring what it is supposed to be measuring. This is a single-indicator model, meaning there is only one indicator for each concept. For single-indicator models, unique estimates of the coefficients are not possible because the model has too few constraints. This means that there is a range of possible values for the estimated coefficients, and only imposing additional constraints will determine unique estimates. Fixing the error variances is one means of providing the additional constraints which are needed to find unique estimates of the coefficients. With these benefits in mind, a decision was made to fix the error variances, a process elaborated upon below.

The percentage of error in measuring the concept (assessed percent error) was assigned by considering the meaning of the variable in the context of the model, and the mechanism through which it would affect other variables in the model. The indicator of the variable should change in response to forces that influence the variable to change. The assessed percent error estimates the extent to which the indicator is influenced by forces that do not first influence the concept.

These assessed percent errors are then used to calculate the error variances. This is done by multiplying the variance of the variable (which can be obtained from the data variance-covariance matrix) by the assessed percent error. To check how reasonable the estimates of the error variances are, Hayduk (1996) suggests testing the model to determine how reactive it is to changes in these assessed percent errors. This is done in the sensitivity analysis of Section 5.6.3.

The error variances for the patient and proxy groups were fixed using the above procedure. The logic of determining the assessed percent error is laid out in the ensuing sections, and is discussed for the two groups separately to review why they may be different. The calculation and justification of the patient error variances will be discussed first, followed by the proxy error variances. After the error variances are set for the two groups, it will be possible to test the model. The model will be tested on the patient data first, followed by the proxy data.

5.2.4.1 THE PATIENT GROUP

The following table (Table 5.5) illustrates the calculation of the error variance for the patient group.

Table 5.5 Assessed Error Variance for the Patients

Variable	**Assessed % Error (%)**	**Variable Variance**	**Estimate of Error Variance**	**Number of Observations**
Age	0.5	49.17	0.246	219
Prestige	10	25.313	2.531	218
Education	10	2.82	0.282	217
Comorbidities	10	2.593	0.259	222
Dementia	20	83.71	16.742	219
Social Support (Pre-fracture)	0.5	0.67	0.003	219
Health Perception (Pre-fracture)	0.5	0.991	0.005	222
Function (Pre-fracture)	10	40.129	4.013	222
Social Support (Post-fracture)	0.5	0.438	0.002	216
Health Perception (Post-fracture)	0.5	0.888	0.004	216
Function (Post-fracture)	10	237.137	23.714	222
Goal	No indicator			

Justification for Patient Error Variances

In setting the assessed percent error, published reliabilities were used if they were available. In the absence of published reliabilities, personal judgement was employed. The following considerations went into determining the assessed percent error for the patient group.

- Age: age is calculated from the patient's birthdate and therefore should be fairly accurate. A 0.5% assessed error is assumed to account for data input errors.
- Occupational prestige: the sixteen categories of the Pineo-Porter Occupational Prestige Scale are broad enough that the maximum error would be to misclassify a patient into an adjacent category. In combination with a small amount of data entry error, a 10% assessed error was assigned to this variable.
- Education: it is unlikely that educational level could be inaccurate by more than one category, and therefore a 10% assessed error is assigned to this variable.
- Comorbidities: comorbidity data from medical records is generally considered to be very accurate. A 10% assessed error allows for some inaccuracy in the number of comorbidities and some data extraction/entry error.
- Dementia: decline in cognitive functioning has shown to be accurately measured by the MMSE. With a reliability of .887, (Folstein,Folstein,McHugh). A 20% assessed error should account for any unreliability and any data entry error.
- (Perceived) Social Support (Pre-fracture and Post-fracture): the question: "is there someone to give you any help at all if you were sick or disabled" should fairly accurately reflect the concept. A .05% assessed error was assigned to account for data entry error.
- Health Perception (Pre-fracture and Post-fracture): this indicator measures what is meant by this concept. When asked "how do you think your health is?" there should be no error except for data entry. A 0.5% assessed error was assigned to account for data entry error.
- Function: how well can a person look after themselves (feeding, walking, hygiene). The Barthel Index should accurately measure this, with reliability of at least 90% (Korner-Bittensky). Therefore, a 10% assessed error was assigned to this variable.

5.2.4.2 PROXY GROUP

The calculation of the error variances for the proxy group are elaborated upon in Table 5.6.

Table 5.6 Assessed Error Variance for Proxy Responses

Variable	Assessed % Error (%)	Variable Variance	Estimate of Error Variance	Number of Observations
Age	1	45.896	0.459	141
Prestige	20	26.668	5.334	140
Education	20	1.9121	0.382	134
Comorbidities	20	2.61	0.522	145
Dementia	20	694.198	138.834	145
Social Support (Pre-fracture)	1	0.638	0.006	143
Health Perception (Pre-fracture)	20	1.091	0.2182	144
Function (Pre-fracture)	15	494.406	74.161	144
Social Support (Post-fracture)	1	0.774	0.008	142
Health Perception (Post-fracture)	20	1.04	0.208	138
Function (Post-fracture)	15	940.896	141.134	145
Goal	No indicator			

Justification For Proxy Error Variances

Research shows (Magaziner) that proxy responses are more accurate for observable factors such as function than for subjective items such as health perception. Generally, while mental and physical functioning are expected to be accurately reported by proxies, internal phenomenon (social support and health perception) are postulated to consist of more error. For the proxy group, health perception and social support will be assigned a greater amount of error (based on personal judgment) than for the patient group, while the error on the other variables will remain similar between the two groups. Based on this, proxy assessed errors were adjusted from the patient assessed errors as follows.

- Age: a 1% assessed error in age reflects a small amount of data entry error as well as some inaccuracy on the part of the proxy to report the birthdate correctly.
- Occupational Prestige: setting a 20% assessed error for prestige reflects the fact that proxies, particularly caregivers at nursing homes, did not tend to have good information on these aspects.
- Education: proxy respondents often lacked good information on educational level attained, and a 20% assessed error reflects this.
- Comorbidities: communication difficulties with health care staff could result in some additional inaccuracy in the reporting of comorbidities. A 20% assessed error was assigned.
- (Perceived) Social Support (Pre-fracture and Post-fracture): this item is somewhat subjective in that it measures whether a patient feels they have someone they can count on. Assessed error was set at 1%.
- Dementia: the mini-mental state exam was given to the patient and therefore there is no increased assessed error resulting from proxy response.
- Function: while proxy reports on function should be fairly accurate, there were some areas, such as toiletting, of which some proxy respondents were unsure. An assessed error of 15% was assigned.

- Health Perception (Pre-fracture and Post-fracture): this is the proxy's perception of how the patient rates health. The rating is on a five point scale, and it is possible the proxy would rate health in an adjacent category from the patient. For example, a patient may have rated health as fair, while the proxy may have said poor or good. Thus a 20% assessed error is assigned here.

5.2.5 Model of Patient's Health Perception

The original LISREL model (Figure 4) was used to model the patient's health perception. As previously discussed (section 3.10.3.4) the chi-square value and the standardized residuals are used to assess the fit between the data and the model-implied covariance matrix. The chi-square value (22 degrees of freedom) of 36.14 was large (p=.029), as were the standardized residuals (Appendix 13). The large chi-square value and large standardized residuals indicate there is not a good fit between the data and the model.

Identifying where there is a lack of fit in the model can assist in understanding why the model is not working. Where there is a lack of fit in the model, there will be large discrepancies between the model-implied and observed covariances. There were four covariances in the model exhibiting these large discrepancies. The model-implied covariances between age and pre-fracture social support and age and the three post-fracture outcome variables (social support, function, and health perception) were much smaller than they should be. In the basic model, these effects have a value of zero because it is postulated that there are no direct effects among these variables. The observed covariances contradict this assertion and suggest non-zero effects exist. In practical terms, this implies that age directly influences post-fracture functioning, health perception, and social support both before and after fracture. This makes sense upon the realization that none of the patient respondents was demented, so that among this group, mental status was likely not causing decreases in pre-fracture social support or the post-fracture variables (function, social support, and health perception). In conclusion, it appears to be reasonable that mental status may not be a strong causal influence among this group of respondents, and this is corroborated by the data.

The mechanisms through which age may influence pre-fracture social support, post-fracture function, post-fracture social support, and post-fracture health perception are as follows. As an individual grows older, friends and relatives die or become physically or mentally incapacitated, leading to less pre-fracture social support. A person with limited pre-fracture social support can maintain himself/herself independently prior to the fracture, but following the fracture when mobility is reduced, the lack of social support becomes more crucial in continuing the previous lifestyle. The caregivers of older individuals are likely to be old and frail themselves, and unable to cope with the added stress of taking care of someone who has suffered a hip fracture and is more dependent than three months ago. This leads to a decrease in post-fracture social support. Aging can also lead to decreases in health perception because the hip fracture can lead to greater disability and may further reinforce the stereotype of aging being a disease. In addition to decreasing social support and health perception, increasing age can negatively influence post-fracture function. This can happen because physiological deterioration caused by increasing age will result in slower recovery from injury, therefore lowering post-fracture function.

The next (revised) run, incorporated the four new age effects, connecting pre-fracture social support and the three post-fracture variables (social support, health perception, and function) to age, into the model. Please see the revised patient LISREL model, Figure 5. The new effects are indicated by dotted lines.

5.2.5.1 THE REVISED MODEL

In the quest for an improved fit between the data and the model, the revised model with the four new effects was run with the patient data. The resulting chi-square value with 18 degrees of freedom of 20.5 (p=.305), indicates the fit of the data to the model was much improved by this addition of the four effects. Another indication of the improved fit was the similarity in the estimated and observed covariances between age and pre-fracture social support and age and the three post-fracture variables (social support, health perception, and function) (Appendix 13).

While the fit of the model was much improved, examination of the model diagnostics (standardized residuals and modification indices) suggested there could be an effect between education and dementia (Appendix 13). This revision was considered to be reasonable because research has shown that increased education has a protective effect on dementia (Christensen et al.). Therefore, this one additional effect between education and dementia was added in to the model.

The assessment of the goodness of fit of the model, with the additional effect between education and dementia included, revealed the following values:

- The model chi-square with 17 degrees of freedom was 15.78 (p=0.54).
- The AGFI (.951) was somewhat low but acceptable.
- The standardized residuals, with the biggest being –2.6, were still somewhat large but tolerable.
- The largest modification index (7.16) was a slightly large but still acceptable.

These values all indicate this is an acceptable model for the patient group, hence no further revisions to this model were made.

5.2.5.2 THE FINAL PATIENT MODEL TO PREDICT HEALTH PERCEPTION

The final patient model and its significant effects are depicted in Figure 6.

Table 5.7 summarizes the size of the effects and the value of the t-statistic associated with each effect. Any effect having a value of the t-statistic greater than two in magnitude is significant at the 0.05 level.

Table 5.7 Effects in the Patient Group *

Effect		t-stat	Standardized Direct Effect	Direct Effect	Indirect Effect	Total Effect
To:	From:					
dementia	age	-1.67	-0.124	-.0146	0.00	-0.146
dementia	education	2.18	0.17	0.876	0.00	0.876
pre social support	dementia	0.515	0.039	0.003	0.001	0.004
pre social support	age	-0.997	-0.068	-0.008	-0.001	-0.009
pre health perception	age	-1.28	-0.079	-0.005	0.003	-0.008
pre health perception	income	0.978	0.09	0.018	0.003	0.021
pre health perception	education	-2.19	-0.204	-0.126	-0.001	-0.127
pre health perception	number of comorbidities	4.8	0.321	0.208	0.038	0.246
pre health perception	dementia	-0.37	-0.026	-0.003	-0.001	-0.004
pre health perception	pre social support	-1.48	-0.089	-0.107	-0.018	-0.125
pre health perception	pre function	-3.4	-0.224	-.037	0.00	-.037
pre function	age	-0.65	-0.047	-0.04	-0.005	-0.045
pre function	income	-0.52	-0.055	-0.07	0.00	-0.07
pre function	education	-0.17	-0.018	-0.068	0.008	-0.06
pre function	number of comorbidities	-3.5	-0.261	-1.027	0.00	-1.027
pre function	dementia	0.126	0.01	0.007	0.002	0.009
pre function	pre social support	0.968	0.067	0.491	0.00	0.491
post social support	age	-2.78	-0.182	-.017	-.002	-.019

(continued next page)

Table 5.7 Effects in the Patient Group (continued)

post social support	dementia	0.112	0.008	0.00	0.001	0.001
post social support	pre social support	3.34	0.217	0.175	0.00	0.175
post health perception	age	-0.05	-0.003	-0.001	0.008	0.007
post health perception	income	-2.06	-0.131	-.026	0.007	-.019
post health perception	comorbidity	2.05	0.142	.087	0.084	.171
post health perception	dementia	-0.81	-0.054	-0.006	-0.002	-0.008
post health perception	pre health perception	3.75	0.253	0.239	0.00	.239
post health perception	goal	-1.18	-0.193	-0.014	0.00	-0.014
post health perception	post social support	-2.22	-0.133	-0.188	-0.014	-0.202
post health perception	post function	-2.34	-0.381	-0.025	0.014	-0.011
post function	age	-2.68	-0.177	-0.37	-0.078	-0.448
post function	dementia	0.367	0.027	0.048	0.011	0.059
post function	post social support	0.896	0.058	1.29	0.00	1.29
post function	pre function	6.35	0.428	1.04	0.00	1.04

***Note: pre is an abbreviation for pre-fracture and post is an abbreviation for post-fracture**

5.2.5.3 SUMMARY OF RESULTS

The practical interpretation of the effects is presented in section 3.10.3.3. For example, each additional comorbidity a patient had lead to an average decrease of one unit (1.027) in pre-fracture function (all other variables controlled). Other effects can be interpreted in a similar manner. Most of the effects, although significant, were small. Please see the final patient LISREL model, Figure 6.

The data indicated that each additional comorbidity an individual had would cause a decrease in his/her pre-fracture function, which would also cause function after fracture to be lower. A respondent with lower pre-fracture function also had lower pre-fracture health perception, which lead to lower post-fracture health perception. In addition, being less healthy (i.e. having more comorbidities) caused an individual's perception of his/her health (both before and after fracture) to be lower. Therefore, each additional comorbidity a patient had negatively influenced all of the outcomes except social support. In summation, deterioration in health, as manifested by increasing comorbidities, causes functional decline and the associated feelings of loss of control over health which leads to a decrease in health perception.

An individual's post-fracture function was found to decrease in response to increasing age. This is likely indicative of the fact that the physiological changes resulting from aging lengthen the recovery time from illness and injury. Aging also caused a respondent to have less post-fracture social support, and a decrease in post-fracture social support lead to lowered post-fracture health perception. One explanation for this chain of events could be that the social support of an older individual will tend to be older as well. Following a hip fracture, when the patient is experiencing prolonged functional dependency, an older caregiver may find the care too demanding and may be unable to continue in a supportive role. As the caregiver withdraws important social support, the patient may experience feelings of abandonment. This may result in feelings of isolation, loneliness, and depression, which will cause an individual's perception of their health to drop. It is hypothesized that in these ways, aging had negative influences on all of the post-fracture outcomes. The absence of direct effects of aging on health perception implied that the stigma of aging as a disease, which caused health perception to be lower, was not supported by these results.

In summary, these findings support the hypothesis that among this group of respondents, it was the very basic biological characteristics (comorbidities, age, and function) that had the most influence on the various outcomes. While an individual's health perception was influenced directly by his/her post-fracture function, respondents were not influenced by the absence of physical recovery (as reflected in the goal variable, please see section 3.6) when rating health. The findings also did not support the contention that a respondent with higher income and/or education, by leading to higher self-esteem, would have increased function.

However, each additional level of education achieved by an individual caused an increase in his/her pre-fracture perception of health, which caused health perception after fracture to be higher. While the patient's level of education was hypothesized to directly influence only pre-fracture health perception, his/her income was postulated to impact health perception both before and after the fracture. These findings indicate that the patient's income influences health perception after the fracture only. This may mean that higher income does not increase health perception by elevating self-esteem, but instead allows an individual to have more control over health. For example, his/her perception of health may increase in response to having more income because it facilitates access to any services and equipment needed to recuperate. Therefore, the hypothesis of positive feelings (self-esteem and control over health) having positive effects on health perception appeared to be upheld in these findings.

Because the MMSE score of all the patients in this group was in the high range (between 21 and 30), mental status was high enough that it had no adverse effect on any of the outcomes.

The only other effects in this model were those between the pre-fracture outcomes and their post-fracture counterparts. The most highly significant effect in the model was that between pre-fracture and post-fracture function, with a one unit increase in function before fracture leading to a average increase of 1.04 units in post-fracture function. This was a strong effect, implying that each one unit increase in the pre-fracture Barthel score leads to a one unit increase in the post-fracture Barthel score. Therefore, the patient in the best physical condition before fracture is likely to be in the best physical condition three months after fracture, again highlighting the importance of the physical component among this group of respondents. The persistence of social support and health perception over time were not as strong as that of function. One possible explanation for this is that health perception and social support are subjective in nature, and some individuals have the personality traits to positively deal with their increased dependence and disability, while others do not.

In conclusion, the strongest effects in the model were those between comorbidities, age, and function both before and after fracture. The individual's health perception was most strongly influenced by feelings resultant from good physical health. Thus, health at its most basic biological level seemed to be the most influential component among this group of patients. Social support had some impact at the post-fracture time point, likely because increased physical dependency made the individual more reliant on social support after the fracture. In contrast to the purely physical effects of good health, however, social support seemed to impact the emotional (health perception) rather than the physical (function) needs of the patient. This implies that social support influences recovery primarily via emotional, rather than instrumental, pathways.

While this is a good fitting model, only 25% of the variance in pre-fracture health perception and post-fracture health perception are explained by the model. A similar amount (23%) of the variance in post-fracture function is explained by the model. Approximately 75% of the variance in these three outcome variables is still unexplained. With pre-fracture social support not being translated into post-fracture social support, the amount of variance still unexplained in post-fracture social support is even higher (91%). This indicates there are likely important explanatory variables, perhaps personality attributes (such as motivation, coping style, or optimism), that are missing. Therefore, while the model provides a good fit to the data, the effects are small and the outcome variables are not well explained by the model. Hopefully the proxy model will more successfully explain the variance in the outcome variables.

5.2.6 The Proxy's Perception of The Patient's Health

When the proxy data was run with the original model, the resulting chi-square statistic with 22 degrees of freedom was 30.88 (p=.099). The standardized residuals did not indicate problems, being reasonably normally distributed and small in value. However, the chi-square value is high and indicates a lack of fit between the data and the model. In an attempt to improve the fit of the model, the 56 observations excluded in the multiple regression analysis will be excluded for the next run.

5.2.6.1 THE REVISED PROXY MODEL

The model was tested on the group of respondents for which MMSE scores had been collected (please see Figure 7). The resulting chi-square value with 22 degrees of freedom was 19.14 (p=.637). This chi-square value was reasonably small, indicating a good fit between the data and the model.

While this model fit well, the effect between education and dementia was added in to keep this model as consistent as possible with the patient model. With the extra effect added in, the goodness of fit measures were as follows:

- The model chi-square with 21 degrees of freedom was 17.77 (p=.664).
- The AGFI was a bit low at .933.
- The standardized residuals were between –2.2 and 2.2.
- The largest modification index was small (5.64).

These measures indicate that this model provides a borderline acceptable fit to the proxy data, and no further revisions were made.

Recall (section 3.10.3.5.) that examination of the standardized coefficients indicates the magnitude of the effects and can warn of estimation problems (if standardized coefficients approach or exceed one). Examination of this standardized solution reveals that most of the standardized coefficients are small, therefore the corresponding effects in the model are small. There are two large standardized coefficients in this model; the coefficient between pre-fracture function (.862) and goal and the coefficient between post-fracture function and goal (-1.186). A similar result was found in the patient model.

Consequently, it is important to consider the cause of this in order to rule out any problems with the model. The standardized effect between both functional variables and goal was large because goal was calculated as the difference between these variables. These were counteracting effects with the influence of pre-fracture function in direct opposition to the influence of post-fracture function. However, the variance in pre-fracture function (40.129) was much smaller than the variance in post-fracture function (237.137). For this reason the goal variable was receiving greater influence from post-fracture function and thus a very large negative value results. This appears to be a plausible explanation for these two large standardized slopes and therefore they are likely not indicative of problems with the model.

The correlation matrix of the eta gives the correlations among the concepts, with large values in this matrix possibly indicating colinearity problems (please see section 3.10.2.5 for further discussion of colinearity). Examination of the correlation matrix yields no alarmingly large correlations (Appendix 14). In fact, the correlation between pre-fracture and post-fracture social support (.604) and the correlation between pre-fracture and post-fracture function (.563) are surprisingly small. One interesting correlation is that between mental status and goal, because there is no effect hypothesized between these two variables. Mental status causes changes in both of the functional variables used in the calculation of goal, therefore implying a correlation between mental status and goal. Two other correlations of interest in this matrix are those between post-fracture health perception and goal (.426) and between post-fracture health perception and post-fracture function (-.438). The size of these two correlations would be expected to be similar. This is because goal and post-fracture function are quite highly correlated, meaning that a change in one tends to be accompanied by a change in the other. Therefore, the two variables tend to change together, and as they change there is an associated change in post-fracture health perception.

The model effects and associated values of the t-statistic are summarized in Table 5.8.

Table 5.8 Effects in the Proxy Group *

Effect		t-stat	Standardized Direct Effect	Direct Effect	Indirect Effect	Total Effect
To:	From:					
dementia	age	1.233	0.114	0.397	0.00	0.397
dementia	education	1.174	0.12	2.281	0.00	2.281
pre social support	dementia	0.072	0.007	0.00	0.00	0.00
pre health perception	age	-2.9	-0.249	-0.034	0.008	-0.026
pre health perception	income	-1.73	-0.2	-0.04	-0.001	-0.041
pre health perception	education	0.739	0.077	0.057	-0.031	0.026
pre health perception	number of comorbidities	2.76	0.297	0.192	0.027	0.219
pre health perception	dementia	0.971	0.097	-0.005	0.004	-0.001
pre health perception	pre social support	-2.52	-0.21	-0.282	-0.004	-0.286
pre health perception	pre function	-3.93	-0.393	-0.018	0.00	-0.018
pre function	age	-1.87	-0.163	-0.494	0.107	-0.387
pre function	income	0.058	0.007	0.03	0.00	0.03
pre function	education	0.923	0.098	1.62	0.612	2.235
pre function	number of comorbidities	-0.96	-0.106	-1.5	0.00	-1.5
pre function	dementia	3.16	0.309	0.267	0.001	0.268
pre function	pre social support	1.015	0.087	2.248	0.00	2.248
post social support	dementia	1.247	0.093	0.004	0.00	0.004
post social support	pre social support	8.99	0.604	0.665	0.00	0.665
post health perception	income	-0.72	-0.078	-0.015	-0.008	-0.023

(continued next page)

Table 5.8 Effects in the Proxy Group (continued)

post health perception	comorbidity	1.112	0.127	0.08	0.041	0.121
post health perception	dementia	1.473	0.192	-0.046	0.041	-0.005
post health perception	pre health perception	1.795	0.202	0.197	0.00	0.197
post health perception	goal	2.29	0.346	0.013	0.00	0.013
post health perception	post social support	-0.73	-0.065	-0.068	-0.081	-0.149
post health perception	post function	-1.54	-0.249	-0.008	-0.013	-0.021
post function	dementia	5.26	0.452	0.539	0.167	0.706
post function	pre function	5.02	0.416	0.572	0.00	0.572
post function	post social support	1.647	0.119	3.828	0.00	3.828

*Note: pre is an abbreviation for pre-fracture and post is an abbreviation for post-fracture

5.2.6.2. SUMMARY OF RESULTS

The proxy model with its significant effects is represented in Figure 8. The results are summarized in Table 5.8. Two of the stronger effects in the model were between dementia and function before and after the fracture. The model confirmed that an increase in an individual's mental status caused higher physical functioning (both before and after fracture), which lead to an increased ability to regain pre-fracture physical function (as measured by the goal variable). As an individual regained physical function, perception of health increased in response.

Each additional comorbidity a respondent had caused a decrease in pre-fracture health perception, but did not lower pre-fracture function. While better pre-fracture physical health (represented by higher function and fewer comorbidities) lead to higher pre-fracture health perception, it had no influence on the post-fracture outcomes. This indicated that physical health was much less influential among the proxy group than the patient group, probably because of the overriding influence of mental functioning and the interplay between the mental and physical components. Cognitive impairment took precedence over physical condition in determining post-fracture outcomes.

Also, age had a smaller influence among the proxy than the patient group. Among the proxy group, an increase in age caused an increase in pre-fracture health perception. The direction of this effect was the opposite to that expected, one possible explanation of this being that perhaps proxies tended to rate health in the context of age. For example, the proxy may have felt that, while the patient had many health problems, overall their health was good for someone of that age.

Unlike the patient group, social support appeared to influence health perception only at the pre-fracture time period. The proxy group, because of their low mental functioning, were likely somewhat dependent before the hip fracture. They may have needed substantial help from a caregiver as much before as after the fracture. Therefore, the social support was not affected by an additional disability. This was further attested to by the very strong effect between social support before and after fracture. This was the strongest effect in the model, perhaps reflective of the nature of the proxy response. The proxy, who was usually the social support for the individual, was often very certain and very consistent (before and after fracture) as to where the patient stood in terms of social support. As was the case with the patient group, the impact of social support seemed to be of an emotional nature rather than an instrumental nature, because it appeared to impact health perception and not function.

The absence of a significant effect between pre-fracture and post-fracture health perception seemed curious. There was some correlation between them because they are both influenced by pre-fracture function and ultimately mental status. This absence of a direct effect may be reflective of the highly subjective nature of health perception and the difficulty it poses for many proxies to try to assess it on behalf of the patient. This suggests that there may be more measurement error in health perception than was assessed. The sensitivity analysis in the following section will address this concern.

In addition to having different amounts of measurement error, the proxy group appeared to differ from the patient group in other ways. Mental functioning influenced (directly or indirectly) all outcomes in this model and therefore was the most influential component. Physical health had the least impact on the outcomes whereas it was an important component in the patient group. In both models, social support tended to have the most impact at the point where the patient was more dependent. The patient group was more dependent at the post-fracture period, whereas dependency was significant both before and after the fracture among the proxy group.

Approximately one third of the total variance in pre-fracture and post-fracture health perception was explained by the model. The model also explained 37% of the total variance in post-fracture social support, and over half (52%) of the variance in post-fracture function. Compared to the patient model (where only 25% of the variance in the outcome variables was explained), this model was more useful in explaining the various outcomes. However, the amount of unexplained variance was still high, indicating important explanatory variables had not been included in the analysis. It is difficult to speculate on the nature of these excluded variables, however they may be associated with the personality, stress, and age of the proxy.

Having developed acceptable models for the patient and proxy groups, the reasonableness of the assumptions made in constraining the error variances was checked. This was done in the subsequent sensitivity analysis.

5.2.7 Sensitivity Analysis

In setting the error variances for this analysis, some subjective assertions about the definitions and behaviours of the concepts and the accuracy with which the indicators would measure these concepts were considered. Hayduk (1996, p.28) recommends performing a sensitivity analysis to examine any changes in the model resulting from dividing a specific assessed percent error by two and then doubling it. For this analysis, with 2 models (patient and proxy) and 11 concepts in each model, this meant doing 44 different runs. An additional run was done on the proxy model by setting all assessed percent errors equal to those of the patient model. Because the error variances were different, the patient and proxy groups are to be discussed separately. The discussion will focus on the patient group, and then on the proxy group.

5.2.7.1 PATIENT GROUP

The assessed percent errors for the patient respondents were small to start with, and changing them resulted in very little change in the overall model. Changes in the assessed percent error of variables with .5% to begin with (age, pre-fracture and post-fracture social support, pre-fracture and post-fracture health perception) had virtually no impact on the model.

When the assessed percent error on pre-fracture function was halved, the model chi-square increased to 16.15 (p=.513) and the effect between pre-fracture and post-fracture function decreased to .98 from 1.04. Doubling this assessed percent error increased this coefficient by .175 (1.179) and decreased the model chi-square to 15.01 (p=.595). This was the maximum change exhibited in any coefficient during this analysis.

During the sensitivity analysis, those coefficients significant in the final model remained significant and insignificant coefficients remained insignificant. The standardized residuals also showed little change as a result of the sensitivity analysis. Therefore, while there were small changes in the model chi-square and some of the coefficients, there were no significant changes.

5.2.7.2 PROXY GROUP

Because the proxies were answering for the patients, more assessed percent error was allotted to the proxy group, which made this model more reactive to the sensitivity analysis. The model was unresponsive to changes in those variables with the smallest amount of assessed percent error (age, pre-fracture and post-fracture social support).

The overall model chi-square value decreased to 17.64 (p=.672) with a halving of the assessed percent error on pre-fracture function, and increased to 18.47 (p=.619) with a doubling of this assessed percent error. These changes in pre-fracture function had the most influence on the overall chi-square value.

The effect between dementia and post-fracture function decreased to .628 from .706 when the assessed percent error on dementia was halved. This same effect (between dementia and post-fracture function) increased to .932 upon doubling the assessed percent error. This was the largest coefficient change.

During the sensitivity analysis, those variables significant in the final model remained significant and those that were insignificant remained insignificant.

There was also no large change in the standardized residuals. Therefore, the significance of the variables did not change during the sensitivity analysis.

When the proxy data was run with the patient assessed percent errors, the significance of the goal variable changed. The goal variable became slightly insignificant (t-value of 1.84) and its effect on post-fracture health perception was almost halved (.008 from.013). The overall significance of the model and the standardized residuals remained essentially the same, but less of the total variance in the outcome variables was explained by the model. There was a decrease of 4 to 8 percent in explained variation in pre-fracture health perception (25%), post-fracture health perception (22%) and post-fracture function (48%). While these decreases were not large, it was preferable to use the model with the original assessed percentages of error because the model did a better job of explaining the variables.

In conclusion, there was not a significant impact on either the patient model or the proxy model upon varying the percentages of assessed error. Therefore, the assumptions underlying the assignment of the error variances for each group appear to be reasonable.

5.2.8 Comparison of the LISREL and Multiple Regression Coefficients

It is noteworthy that the five significant effects in the multiple regression analysis also are the five significant direct effects on post-fracture health perception in the patient LISREL model (Table 5.9). Although the magnitude of the effects between the two analyses differ, the coefficients remain small and of the same sign.

Table 5.9 Comparison of LISREL and Multiple Regression Coefficients in Predicting Post-fracture Health Perception *

Variable	LISREL Coefficient (final patient model)	Multiple Regression Coefficient
Occupational Prestige	-0.02	-0.026
Number of Comorbidities	0.087	0.08
Pre Health Perception	0.239	0.2
Post Social Support	-0.188	-0.13
Post Function	-.025	-0.01

*Note: Pre is an abbreviation for pre-fracture and post is an abbreviation for post-fracture

Approximately one quarter of the total variance in post-fracture health perception was explained by the regression analysis and by the LISREL model. This indicates that the low R-square (.25) is not due to measurement error because this was adjusted for in the LISREL model. Model misspecification is another possibility, however there is no theoretical evidence to suggest nonlinearity or nonadditivity. This leaves the possibility that important variables were excluded from the analysis, which is entirely possible when the dependent variable is one as subjective and personal as health perception.

5.2.9 The Multiple Indicator Model

There is one additional component of the LISREL analysis to be discussed. It is possible to have a model with concepts having more than one indicator, and this is called a "multiple indicator" model. If both indicators truly measure the same concept, meaning they are both influenced by the same causal processes, the result will be a good fit between the data and the model. In this way, a good fit between the data and the model also supports the contention that both indicators are measuring what they should be measuring and therefore support the validity of the two measures. In this study two measures of health perception were collected for the patient respondents, making it possible to test a model incorporating multiple indicators of health perception. It was expected there would be a good fit between the model and the data because both of these indicators were assumed to be measuring the same concept (health perception).

One of the health perception measures asked patients to rate their health on a five point scale from poor to excellent (the measure used thus far in the analysis). The value of this measure collected before the fracture will be called prehealth and the value collected after the fracture will be referred to as posthealth. The other measure, called the EuroQol thermometer, required respondents to rate their health on a scale from 0 to 100 (0 representing worst possible health imaginable and 100 being best possible health imaginable). The pre-fracture measure of the EuroQol thermometer will be called prethermometer and its post-fracture counterpart will be referred to as postthermometer.

There were more missing values for the postthermometer variable than for the other three health perception variables. Responses for this entity were missing for 51 of the possible 222 patient respondents (23%). This was likely because some respondents had difficulty rating their health on a scale from 0 to 100, and chose not to answer it. Hence, consideration was given to removing those with missing postthermometer responses from the analysis (leaving a sample of 171 patients). The implications of excluding these respondents are addressed below. While this may introduce some bias into the sample (relating possibly to age and/or education) the objective of this analysis was to examine the causal pathways between the pre-fracture health indicators and the post-fracture health indicators. To do this, it is beneficial to have complete information on all the health indicators.

The multiple indicator model (Figure 9) was constructed by modifying the patient model of health perception (Figure 5) to include an additional indicator of health perception at both the pre-fracture and post-fracture time periods. While the patient model provided a good fit to the total sample (222 patients) of respondents, it was recognized there may not be a good fit between the patient model and the reduced sample (171 patients). This was because the pairwise covariance matrix calculated using all 222 individuals and the covariance matrix calculated using the 171 respondents utilized different sets of individuals which can produce different results (please see section 3.10.3.2 for further explanation of pairwise covariance matrices). Some differences were expected between the covariance matrix used in developing the patient model to predict health perception (which included all the data) and the covariance matrix excluding 51 observations. Before omitting the 51 individuals, the patient model was checked with the reduced sample to ensure the existence of a good fit of the patient model with the smaller sample. The chi-square value using the sample of 171 individuals (9.6 with p-value of 0.92) was smaller than the chi-square value when all 222 respondents were included (15.78 with p-value of 0.54). However, a reduction in sample size will result in a smaller chi-square value (and larger p-value) because the chi-square test will have less power to detect important differences between the sample and the model-implied covariance matrices.

Therefore, in assessing the fit between the model and the data, the standardized residuals were examined also. The standardized residuals were smaller as well, with the largest standardized residual for both models (involving the same covariance between comorbidities and post-fracture health perception), dropping to 1.8 from 2.6. Using the smaller sample instead of the larger sample resulted in both the chi-square value and the standardized residuals being smaller, indicating a better fit between the model and the reduced sample. Based on the fact that there was a good fit between the patient model and the sample of 171 individuals, a decision was made to exclude the 51 respondents with missing values for the postthermometer variable.

The multiple indicator model (Figure 9) had two indicators of pre-fracture health perception (prethermometer and prehealth) and two indicators of post-fracture health perception (postthermometer and posthealth). In defining the measurement for the latent variables with multiple indicators, the scale of measurement can be established by setting one of the lambda coefficients, (these are the coefficients that connect the indicator to the concept), equal to one. For pre-fracture health perception, for example, the scale of measurement could be determined by fixing either prehealth or prethermometer. Prehealth was fixed because it was judged (by the researcher) to be the most accurate of the two indicators of pre-fracture health perception. The error variance for this indicator was also prespecified to correspond to the accuracy with which this indicator is thought to measure health perception (please refer back to section 5.2.1 for justification of this error variance). This serves to provide a definition for pre-fracture health perception in terms of prehealth. The use of multiple indicators implies that prethermometer, although scaled differently than prehealth, will react to changes in pre-fracture health perception in exactly the same way as prehealth. Likewise, post-fracture health perception was defined in terms of posthealth.

The following discussion will focus only on the health perception portion of the model because this is where the multiple indicators are. There is a significant correlation between both indicators of health perception (EuroQol thermometer and the five point scale), because they share a common cause (health perception). Furthermore, the model postulates that increases in pre-fracture health perception cause increases in post-fracture health perception. Therefore, this model claims that an increase in pre-fracture health perception causes several events to happen in the health perception part of the model: 1) both indicators of pre-fracture health perception will change; 2) post-fracture health perception will increase; 3) both indicators of post-fracture health perception will change. This means that the only causal connection between the pre-fracture and the post-fracture indicators is through the health perception concepts. For example, an increase in the value of the pre-fracture EuroQol thermometer (prethermometer), caused by an increase in pre-fracture health perception, leads to an increase in the post-fracture EuroQol thermometer (postthermometer).

This results from an increase in post-fracture health perception which occurs in response to higher pre-fracture health perception. Alternatively, higher values of prethermometer cannot directly cause higher values of postthermometer because the model alleges that there is no direct effect between prethermometer and postthermometer.

Because this is a multiple indicator model, prethermometer cannot change without being accompanied by a corresponding change in prehealth, with analogous changes being exhibited by postthermometer and posthealth. In summary, there is a complex causal system connecting these four indicators. This causal system imposes constraints (called proportionality constraints) on the covariances between the indicators. The ensuing discussion will provide more detail as to the nature of these constraints, but at this point it is sufficient to say structural equation models with multiple indicators "imply a strict proportionality between the indicator loadings (λ's) and the indicator covariances with each and every other modeled variable." (Hayduk, 1996).

Upon running the multiple indicator model, the overall chi-square value was 48.2 (p=.124). There were some large standardized residuals, the largest (3.77) being between the prethermometer and postthermometer variables. The model diagnostics (a modification index of 7.299 for the measurement error covariance between prethermometer and postthermometer) indicated that significant improvement to the model would result from allowing a correlation between the measurement errors of prethermometer and postthermometer.

Thus when allowing for a correlation between the measurement errors of prethermometer and postthermometer there was a substantial improvement in the fit of this revised model, resulting in a chi-square value of 40.44 (p=.321) and an AGFI of .916. While some of the standardized residuals were still a bit large, all were less than 3. Although the fit between the model and the data had improved, the p-value was still unacceptably small. This was a borderline failing model with no satisfactory means of fixing it.

It is important to understand why the model fails and this is where the proportionality constraints can give some insight. For the basic multiple indicator model to work, "we must observe one proportionality within the rows and a second proportionality within the columns, in the 'between concept' portion of the observed indicator covariance matrix." (Hayduk, 1994, p.17). Therefore, the covariances of all the causes of the multiple indicators must be proportional within both the rows and the columns of the sample covariance matrix. The four health perception indicators were one example of a group of variables that did not exhibit proportionality. For example, the covariance between prehealth and postthermometer (-7.094) was larger than the covariance between prehealth and posthealth (.373) by a factor of 19. The proportionality constraints dictate the corresponding covariances between prethermometer and the post-fracture health indicators must also differ by a similar amount. These covariances differed by a larger factor (27), suggesting a lack of proportionality. This lack of proportionality was reflected in the estimated covariances, with three of the covariances being underestimated, and the covariance between prethermometer and postthermometer being approximately half the value it should be.

By allowing a correlation between the measurement errors of prethermometer and postthermometer, the fit of the revised model to the data was improved because the proportionality assumption for the multiple indicators no longer applied.

The fact the model does not work indicates the single causal pathway between the pre-fracture health indicators and the post-fracture ones is incorrect. The model diagnostics suggest that allowing for more error variance on posthealth (modification index of 6.613) could significantly improve the fit of the model. The problem with freeing this error covariance is that it changes the definition of the concept of post-fracture health perception, which jeopardizes the theory upon which the model was constructed. This measurement error was assigned and justified previously in this chapter, and was based upon familiarity with the theory and data collection methodology. Furthermore, changing this error variance will make the definition of posthealth perception less precise, allowing for the definition to become more similar in definition to the postthermometer variable. This is definitely undesirable and this change will not be acted upon.

Only 22% of the variance in the pre-fracture EuroQol thermometer variable and approximately one third (32%) of the variance in the post-fracture EuroQol thermometer variable were explained by the concepts of pre-fracture and post-fracture health perception. Clearly the EuroQol thermometer variables were not being well explained by health perception as defined by prehealth and posthealth. These results indicate the model is not explaining these two variables well and that much of their variance is due to causes other than those influencing prehealth and posthealth. The inconsistency between the two health perception measures leads to concerns about the validity of these measures. Recall that one indicator is the subjective rating of health on a five point scale from poor to excellent (prehealth and posthealth) while the other indicator is the subjective rating of health on a scale from 0 to 100 (prethermometer and postthermometer). Both are subjective ratings of health, differing only in scale, and these results indicate there are different causes of one than the other. In other words, the same concept is not being described by both measures.

There are many possible explanations for this result. For example, several respondents had problems finding a number between 0 and 100 to describe their health. Perhaps inexperience with this type of scale contributed to this inconsistency between measures. Another possibility is that using the other scale (prehealth and posthealth) in this frail population was problematic because of the limited choice at the lower end of the scale. With only poor or fair to choose from, there may have been a problem related to a lack of discrimination.

Both of these problems would be addressed by increasing the amount of measurement error on health perception.

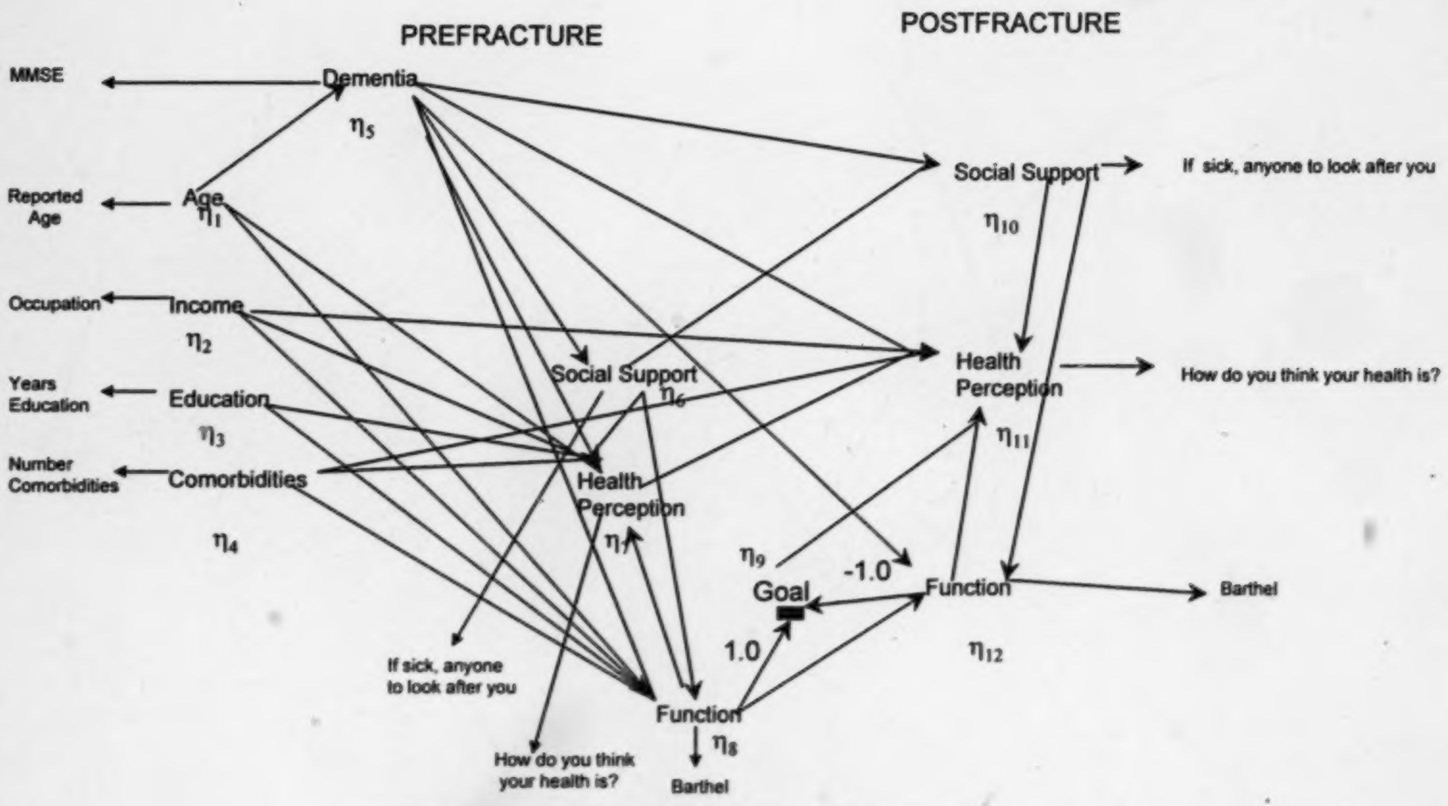

PREFRACTURE
POSTFRACTURE
MMSE
Dementia
η_5
Reported Age
Age
η_1
Occupation
Income
η_2
Years Education
Education
η_3
Number Comorbidities
Comorbidities
η_4
Social Support
η_6
Health Perception
η_7
If sick, anyone to look after you
How do you think your health is?
Function
η_8
Barthel
Goal
η_9
1.0
-1.0
Social Support
η_{10}
If sick, anyone to look after you
Health Perception
η_{11}
How do you think your health is?
Function
η_{12}
Barthel

FIGURE 4 ORIGINAL (BASIC) LISREL MODEL*

* exogenous concepts are correlated

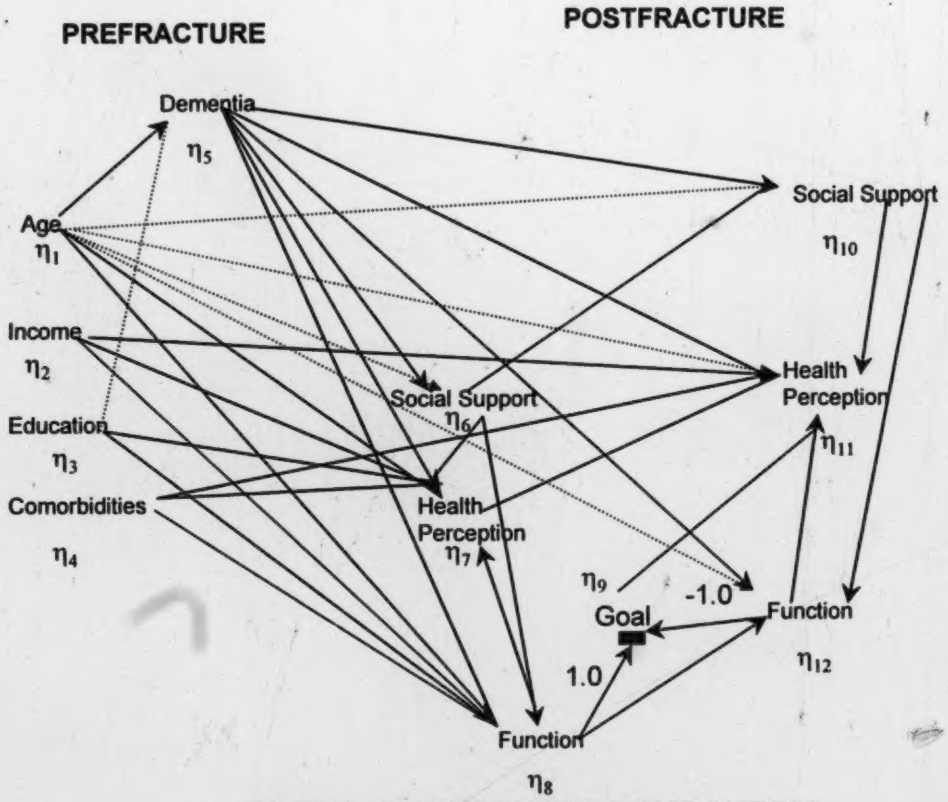

PREFRACTURE
POSTFRACTURE
Dementia
η_5
Age
η_1
Income
η_2
Education
η_3
Comorbidities
η_4
Social Support
η_6
Health Perception
η_7
Function
η_8
η_9
Goal
1.0
-1.0
Social Support
η_{10}
Health Perception
η_{11}
Function
η_{12}

FIGURE 5 REVISED PATIENT LISREL MODEL*

*exogenous concepts are correlated

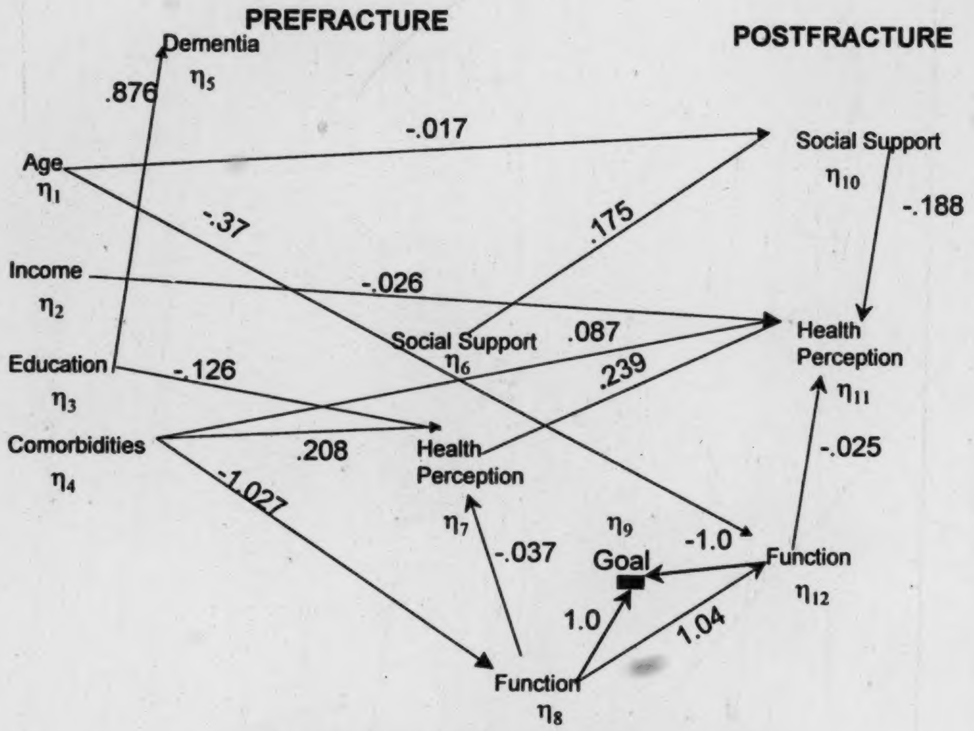

PREFRACTURE
POSTFRACTURE
Dementia
η5
.876
Age
η1
Income
η2
Education
η3
Comorbidities
η4
-.017
-.37
-.026
-.126
.208
-1.027
Social Support
η6
.175
.087
.239
Health
Perception
η7
-.037
Function
η8
1.0
1.04
η9
Goal
-1.0
Social Support
η10
-.188
Health
Perception
η11
-.025
Function
η12

FIGURE 6 FINAL PATIENT LISREL MODEL*
* exogenous concepts are correlated

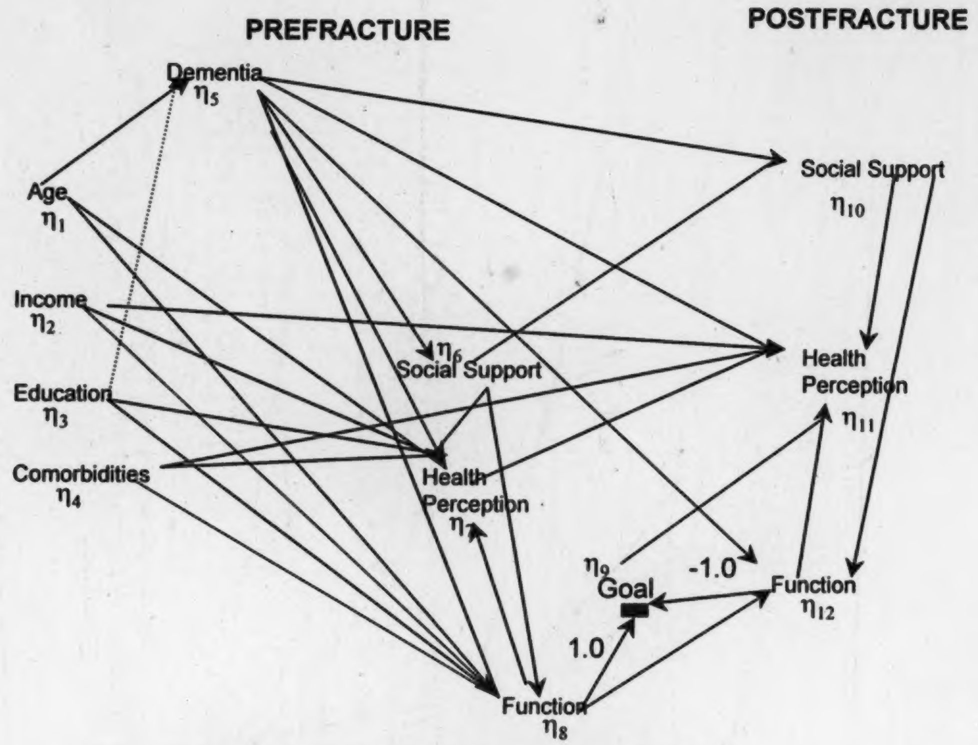

PREFRACTURE
POSTFRACTURE
Dementia η_5
Age η_1
Income η_2
Education η_3
Comorbidities η_4
η_6 Social Support
Health Perception η_7
Function η_8
η_9 Goal
1.0
-1.0
Social Support η_{10}
Health Perception η_{11}
Function η_{12}

FIGURE 7 REVISED PROXY LISREL MODEL*
* exogenous concepts are correlated

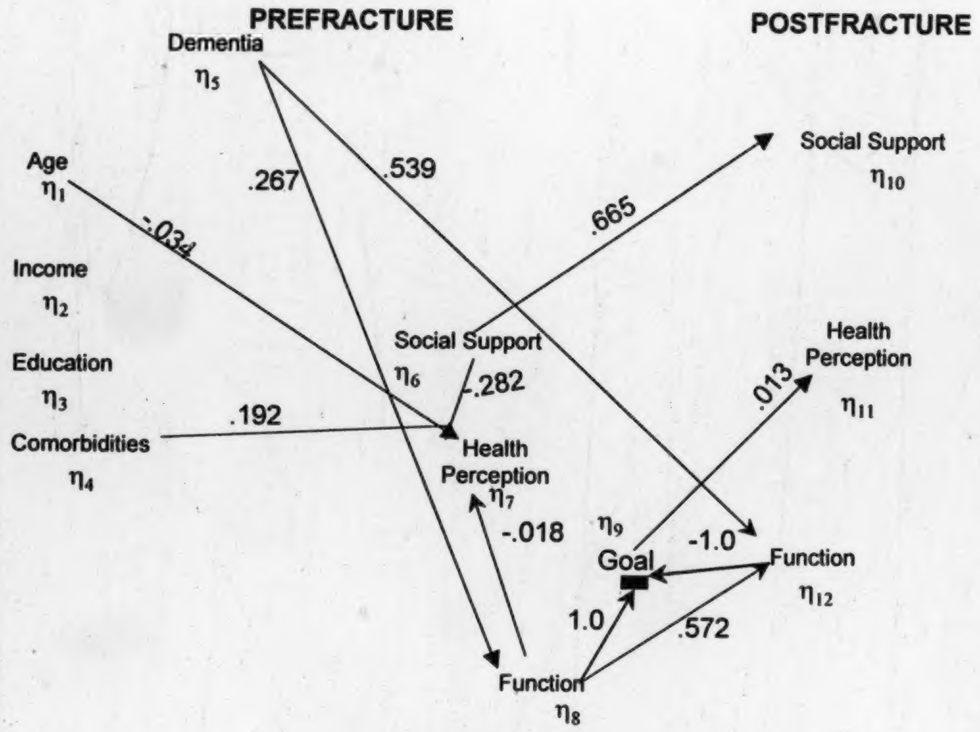
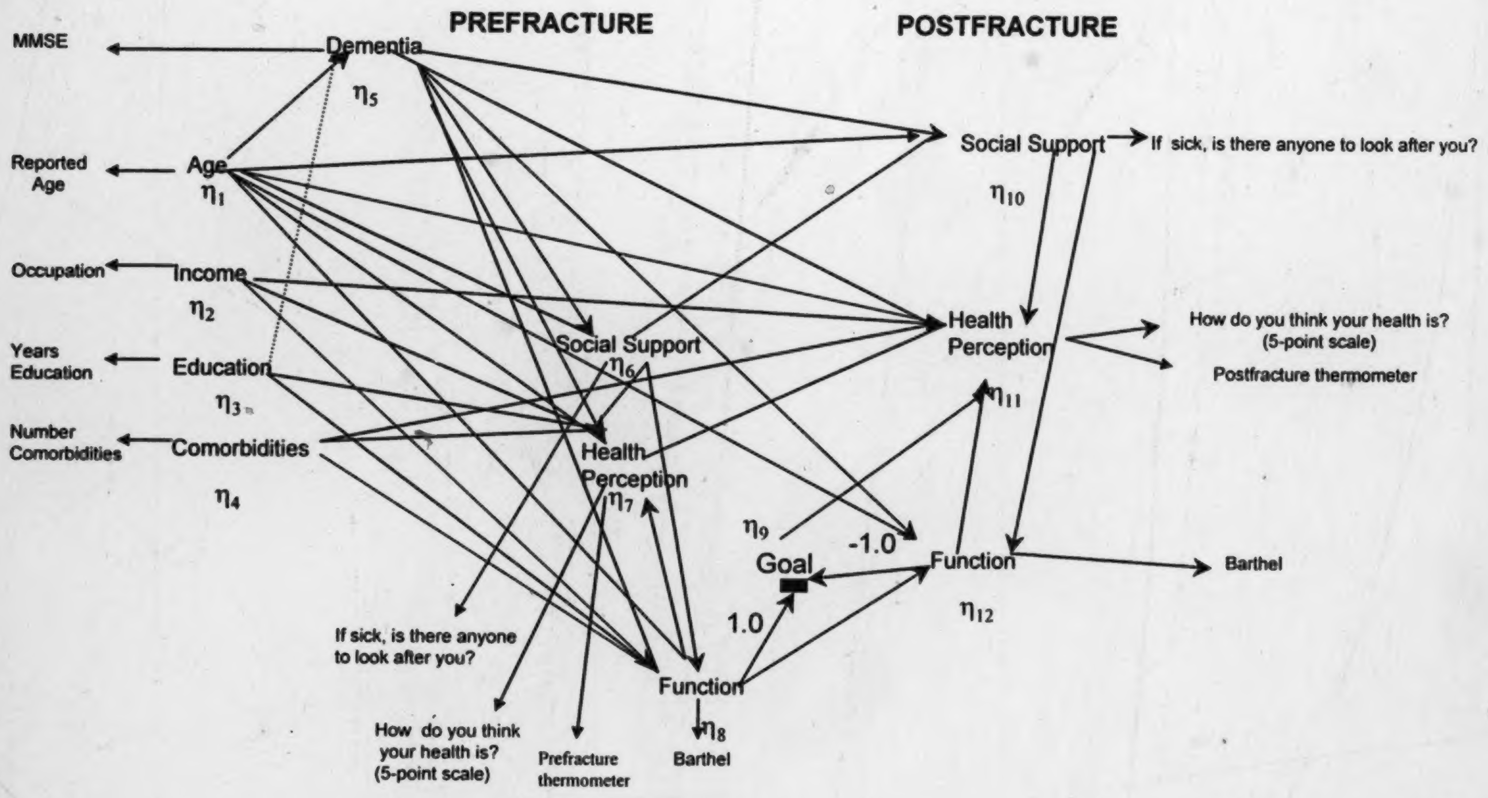

PREFRACTURE
POSTFRACTURE
Dementia
η_5
Age
η_1
Income
η_2
Education
η_3
Comorbidities
η_4
.267
.539
-.034
.192
Social Support
η_6
-.282
Health
Perception
η_7
-.018
Function
η_8
.665
Social Support
η_{10}
Health
Perception
η_{11}
.013
η_9
Goal
1.0
-1.0
.572
Function
η_{12}

FIGURE 8 FINAL PROXY LISREL MODEL*
* exogenous concepts are correlated



PREFRACTURE
POSTFRACTURE
MMSE
Dementia
η_5
Reported Age
Age
η_1
Occupation
Income
η_2
Years Education
Education
η_3
Number Comorbidities
Comorbidities
η_4
Social Support
η_6
Health Perception
η_7
Function
η_8
Barthel
If sick, is there anyone to look after you?
How do you think your health is? (5-point scale)
Prefracture thermometer
η_9
Goal
1.0
-1.0
Social Support
η_{10}
If sick, is there anyone to look after you?
Health Perception
η_{11}
How do you think your health is? (5-point scale)
Postfracture thermometer
Function
η_{12}
Barthel

FIGURE 9 MULTIPLE INDICATOR LISREL MODEL*
* exogenous concepts are correlated

CHAPTER 6

DISCUSSION

VALIDITY OF RESULTS

6.0 DISCUSSION

The purpose of this study was to identify those risk factors associated with poor outcome following hip fracture. The poor outcomes studied included mortality, institutionalization, and health perception.

The study was a prospective cohort design, following up all patients for three months following a hip fracture. All patients aged 65 and over and residents of the Edmonton area were potential respondents for this study. The findings are summarized below.

6.1 THREE-MONTH MORTALITY FOLLOWING HIP FRACTURE

This study examined the determinants of three-month mortality among hip fracture sufferers residing in either the community or an institution at the time of fracture. The mortality rate of 8% found in this study is comparable to the three-month mortality rate reported by Magaziner et al.of 8.2%. While lower rates (6.5%) have been reported among the community-dwelling elderly with good mental functioning (Aharonoff et al), the study by Magaziner included home-dwelling elderly with severe mental impairment, thereby being more similar to patients in this study.

Studies examining determinants of mortality following hip fracture have examined various combinations of covariates. Several studies have found a higher risk for males than females. However, this has not always persisted after controlling for possible confounders. In studies where gender was found to be significant (Myers et al, Kellie and Brody), it often has been reported that males have approximately twice the risk of females. However, these studies have not controlled for the socioeconomic variables of education and occupation. Therefore, in this study the odds ratio of 2.3 found between mortality and gender, when not controlling for other covariates, is similar to that found in other studies. However, when controlling for other covariates, the four-fold increased risk associated with male gender is higher in this study than that found by other investigators. This may be because other researchers have not controlled for the same group of covariates as were controlled for in this analysis.

Risk of death following a hip fracture has been found to be elevated in those with poor mental functioning. Marottoli et al.found that, after controlling for comorbidities and complications, risk of death was almost seven times higher in those of low as compared to high mental functioning. While mental status was kept as a continuous variable in this study, the increased risk associated with low as compared to high mental status was estimated to be 1.57 (section 4.2.3). This is conservative relative to that found by Marottoli et al. However, they used a different measure of mental status and controlled for different covariates. Generally, the findings of this study agree with much of the other research that indicates an increased mortality risk with decreased mental functioning.

6.2 THREE-MONTH INSTITUTIONALIZATION FOLLOWING HIP FRACTURE

Institutionalization following hip fracture has received much less study than mortality. More research in this area has been done in the past few years, as investigators recognize the impact of institutionalization on quality of life. Cumming et al.have reported that, independent of age and mental status, hip fracture is a major risk factor for institutionalization. Controlling for age and gender, Cumming et al.found that risk of institutionalization was five times higher among those who had broken a hip than those who had not suffered this injury. These researchers reported a three-month institutionalization rate following hip fracture of 16%, which closely resembles the 17% rate found in this study.

Marottoli et al, in identifying pre-fracture risk factors for institutionalization following a hip fracture, examined a range of determinants including: mental and physical function, social support, age, gender, race, education, complications, comorbidities, fracture site, and self-rated health. These investigators found that of all the determinants examined, only poor mental status increased this risk (OR=9.11). In this study, when examining the pre-fracture variables only, low mental status increased the risk of institutionalization by a similar amount (OR = 8.1).

While Marottoli et al.found age was not significantly related to risk of institutionalization, other results have contradicted this. For example, Cumming et al.found each additional year of age over the age of 65 (controlling for gender, age, mental and physical functioning, social support, and medical conditions), increased the risk of institutionalization by 10% (hazard ratio of 1.1). Similarly, this study found that controlling for mental status, each additional year of age increased institutionalization risk by 10% (OR=1.1). Therefore, these findings indicate that, at the time of admission to the hospital and using only the available pre-fracture information, those who are older and/or those with lower mental function are at increased risk of institutionalization.

The results of this study also indicate that, at the time of admission to the hospital, if there is a way to use the pre-fracture information to estimate post-fracture function, the best set of predictor variables for institutionalization at three months would be age, mental status, and post-fracture function. Individuals of low mental function are at 3.6 times the risk of institutionalization as those of higher cognitive ability. There are no other studies that have examined these particular covariates in predicting institutionalization, and therefore these effects cannot be compared to other findings. Marottoli et al.reported that their data suggested a trend towards increased risk of institutionalization in those with poorer pre-fracture function, while Parker and Palmer found that pre-fracture mobility was more significantly related to returning home post-fracture than mental status or physical health. The results of this study indicate that poorer pre-fracture function is predictive of decreased post-fracture function. While age and mental status place an individual at increased risk of institutionalization, these characteristics are not amenable to intervention. Interventions can be implemented to improve post-fracture function however, and this study suggests increased function would reduce the risk of institutionalization.

6.3 HEALTH PERCEPTION FOLLOWING HIP FRACTURE

This study sought to identify variables affecting health perception (a component of quality of life) among hip fracture patients. While the multiple regression analysis served to delineate the direct effects on health perception, the LISREL model provided a more detailed description by clarifying the indirect causes as well. Very little research has been done to determine health perception among hip fracture sufferers, particularly among respondents with low cognitive function. Research on measuring health perception and quality of life among those with dementia is just beginning, and no studies are available that examine the quality of life among those individuals who have also survived a hip fracture.

Borgquist et al, in examining health perception among community-dwelling hip fracture survivors, reported that the physical conditions (pain, mobility) were the most influential on health perception. These community-dwelling elderly would likely also have had high mental functioning and therefore could be compared to the patient group (those with higher mental functioning) in this study. Results of the LISREL analysis indicated that, among those with higher mental functioning, the physical predictors (age, comorbidities, and function) had the most influence on health perception. This defends the hypothesis that good health would lead to positive feelings of having control over health, which would positively influence health perception. While the physical components dominated among this group of respondents, the emotional support provided by a caregiver significantly influenced health perception also. Those with more social support rated health higher than those with less social support.

While the physical domain was most important among the patient respondents, mental functioning was of primary influence among the proxy (cognitively impaired) patients. The mental and physical functioning are so strongly connected that it often is difficult to separate the two, particularly when evaluating health perception. For example, it is often difficult to know if an individual does nothing but watch television all day because of discomfort resulting from the hip fracture or because of poor mental functioning. The findings in this study indicated that health perception was influenced by the absence of physical recovery exhibited by the patient. The absence of physical recovery, in turn, was dependent upon the patient's mental status. In addition to mental status, social support was important in providing some emotional comfort for these individuals. Health was rated higher in those with more social support than in those with less social support. Many of the effects hypothesized to influence health perception were found to be insignificant in this study. Little discussion has evolved around the failure to find effects because the research in the area of health perception is sparse and there are few other studies with which to compare results.

The LISREL model also tested the validity of two measures of health perception. Several studies have reported on the validity of different measures of health-related quality of life among elderly orthopedic patients (Liang et al, Stucki et al). However, no research has been done specifically on rating health in elderly orthopedic patients. Therefore, two measures were considered, one rating health on a five-point (ordinal) scale from poor to excellent, and the other rating health on a numerical scale from 0 to 100. The hypothesis was that patients would be consistent in rating their health on the ordinal and the numerical scales; however, the data did not support this hypothesis. This tends to discredit the validity of the scales because it implies these scales are measuring different concepts. Because of the lack of research in this area, reasons for this inconsistency can only be speculative in nature. It is not known if this result is specific to this frail elderly population or if it would occur in other populations as well. If it is specific to the frail elderly population, perhaps it is the result of inexperience in rating health on a numerical scale (EuroQol). It may also reflect a lack of discrimination at the lower end of the ordinal scale. There are many other possible explanations, all of which could require further investigation to confirm them.

Assessing causality and validity of the findings requires consideration of the strengths and weaknesses of the study design, issues of confounding, and criteria related to causality. In addition to these general concerns, a discussion of the results of this study will address the specific measurement and ethical issues posed in a study of the elderly population.

6.4 ISSUES OF STUDY DESIGN

This was a population-based prospective cohort study design. This design was deemed the strongest of the possible types of study that could be undertaken to investigate the determinants of outcomes following a hip fracture. The limitations of this study type also were recognized and all attempts were made to deal with these. Strengths and weaknesses of this study are outlined below.

6.4.1 Strengths of the Study Design

There are several advantages to using a cohort study design in investigating outcomes following hip fracture.

Outcome: cohort studies allow for the investigation of more than one outcome (mortality and morbidity) resulting from the same exposure. The fact that poor outcomes are common and occur within a short period (three months) following hip fracture makes a cohort study a feasible approach for investigating determinants of outcomes following hip fracture.

Estimate of risk: in this study, estimates of the incidences of different outcomes and relative risk were of primary interest. This study design allowed for estimates of the incidences of mortality and morbidity during the three months following hip fracture. It also allows direct calculation of the relative risks associated with different exposures such as functional status or amount of social support.

Causal inference: one strength of this study design is that the exposures are measured before the outcomes occur, thus establishing temporality between exposure and outcome. There are other criteria necessary to infer causality, but temporality is a particular feature of the cohort study design, whereas the other criteria are not. The ensuing discussion will address the causal implications of the study findings in relation to the other criteria.

6.4.2 Weaknesses of the Study Design

All study designs are prone to certain biases which can invalidate the findings. Prior to any discussion of causality, it is important to discuss the weaknesses inherent in the design of the study. Cohort studies are susceptible to the following types of bias.

Misclassification bias: bias occurs when respondents are improperly classified according to both outcome or exposure. In this study, misclassification according to outcome will be impossible in terms of mortality and minimal in regards to institutionalization. However, there are acknowledged measurement problems pertaining to the exposure variables, health perception in particular, and all possible steps were taken to minimize these.

Loss to follow-up: loss to follow-up occurs when respondents drop out of the study. All efforts were made to prevent losses to follow-up. However, when they did occur, attempts were made to obtain outcome measures. The numbers lost to follow-up were small, likely because of the short follow-up period.

Non-participation: this is of concern if those refusing differ in some way from those participating in the study. In this case, the response will be biased if the differences are related to both exposure and outcome. In this study, the number of refusals was small. Demographic characteristics of those who participated and those who refused were similar indicating that non-participation was unlikely to have biased the results.

6.5 VALIDITY OF THE STUDY RESULTS

In addition to bias, confounding and chance are important in assessing the validity of the results. Statistical testing and estimation are carried out to diminish the likelihood of making conclusions based on chance occurrences.

A number of variables (age, gender, mental status and number of comorbidities) were collected as possible confounders. Age and gender, being related to both outcome and exposure, are usually considered to be confounders. The other covariates (mental status and number of comorbidities), preceded but were associated with the pre-fracture variables (function, social support, and health perception) and the post-fracture outcomes. Thus age, gender, mental status, and number of comorbidities were collected as possible confounders and were controlled in order to ensure valid inferences.

6.6 INFERRING CAUSALITY

Assuming the results are valid, there are a number of criteria to consider in judging causality. Cohort study designs usually account for the temporality criterion. Additional concerns in judging causality (Hennekens et al) are those indicated below.

Strength of the association: the stronger the association between exposure and outcome, the greater the support for causality. None of the associations between exposure and outcome were very strong in this study, making it harder to rule out the possibility of other explanations for the observed association.

Biological plausibility: if there were known mechanisms through which these exposures work to cause the outcomes, this would lend support to causality. For this study, these mechanisms have been previously discussed (section 2.10) and are supported by other research.

Consistency with other research: other studies having similar results will support causality. The results of this study, summarized in the following chapter, are consistent with other research that has been done with elderly hip fracture patients.

Dose-response relationship: if risk changes as exposure increases, this suggests causality. The assumption of a linear relationship between exposure and disease risk was inherent in all the analyses. A dose-response relationship was supported by the goodness-of-fit between each of the models and the data.

These are often the criteria used to judge causality (Hennekens), however there are three other criteria that could be considered (Hill). The findings should be based on experimental evidence, the findings should not contradict current knowledge (coherence) and similar exposures will have similar effects (analogy). The results of this study do not contradict current knowledge, however this was an observational study design and not a randomized control trial (experiment). Analogy is somewhat more abstract to consider but seems reasonable. For example, if it is known that higher income causes higher health perception, a similar exposure such as higher occupational prestige will also cause higher health perception.

While causality can only be inferred from a non-experimental study design such as a cohort study, the data seem to provide reasonable evidence to support the fact that although the observed associations are weak, they are causal. The lack of strong associations between the outcome and the exposure imply that, for each of the outcomes, important causal variables have been excluded from the analysis. In identifying some of these excluded causal variables, it is important to review the particular challenges faced by the elderly and some of the difficulties in doing research among the frail elderly.

6.7 RESEARCH ISSUES RELATED TO THE FRAIL ELDERLY POPULATION

Any discussion of the elderly population must begin with the acknowledgement that, although there are certain common characteristics of this group as a whole, it is certainly not a homogeneous group. Hip fracture survivors often undergo enormous changes in their lives. Physical, social, and mental changes interact in complex ways to influence independence and quality of life by altering health and sometimes forcing the relocation of the patient. In addition, the family and the medical system tend to send conflicting messages to the patient. Rehabilitation focuses on regaining independence while at the same time there are pressures to move into institutions which tend to promote the acceptance of dependence. Each patient, influenced by his/her own set of values and personality, will cope with these pressures in his/her own way. This makes health perception difficult to quantify.

The issue of mental incompetence adds another dimension to the measurement dilemma. Proxy responses impose different value systems, personalities, and coping strategies on the highly subjective perception of health. For this reason, it becomes necessary to assume that the proxy responses will be less accurate than the patient responses. In addition to the measurement problems, there are the ethical concerns involving informed consent and paternalism. Allowing the proxies to respond on behalf of the patients was necessary for those patients who were unable to respond for themselves. The onus was on the proxy to respond to the questionnaire in what they perceived to be an accurate interpretation of the beliefs and wishes of the patient. This action did not appear to be difficult for most proxies, likely because of the non-invasive nature of the study.

CHAPTER 7

SUMMARY AND CONCLUSIONS

7.0 SUMMARY AND CONCLUSIONS

One of the objectives of this study was to identify those variables, present at admission, that would indicate an individual at high risk of death or institutionalization within the three months following a hip fracture. "Poor mental functioning" is one indicator of increased risk for both outcomes, with "poor mental status" increasing the risk of institutionalization almost ten-fold. Male gender and increasing age are also related to higher risk of poor outcome, with the risk of death being four times higher for males than for females. Also, those over the age of 85 years have 28 times the risk of institutionalization as those under the age of 75. Having identified the high risk individuals, the second step would be to do the analyses again using only modifiable variables. It is clear that age, gender, and dementia cannot be altered. The most likely intervention strategy to prevent institutionalization may be rehabilitation programs specifically designed to increase physical function within three months after hip fracture. Physical functioning was an important influence for all patients, although the effectiveness of physical rehabilitation would be mediated by the mental status of the patient.

The purpose of identifying influences of health perception three months after fracture was to identify interventions to increase health perception and, thus, the quality of life. It has been found that an individual living to the age of 65 can expect to live an average of almost 17 more years, spending almost 41% of these additional years dealing with some limitation in activity. For some individuals, this disability will be caused by a hip fracture and it is important to identify means of increasing autonomy and hence the quality of life for the longest possible period of time. While high mental functioning was important in regaining independence, the individuals in this study also were in need of social support following the hip fracture. These people often were in need of assistance in fulfilling basic needs such as meeting appointments or shopping. Providing these services may compensate to some extent for a lack of social support.

One final result of the LISREL analysis was the finding of the inconsistency in the two measures of health perception. This leaves the validity of these two measures in question. At this point, explanations can only be speculative. It is possible that there is an age or education factor leading to inexperience with rating health on a numerical scale (EuroQol). Alternatively, the inconsistency may be a failing of the scale, specifically if there is not sufficient discriminatory power at the lower end of the five point scale to measure health properly among this frail population. These are two possible explanations for this interesting result, but with the increasing interest in measuring health perception as one determinant of quality of life among the frail elderly, this is deserving of further study.

One of the unique features of this study was the large spectrum of variables collected as possible confounders. This is in contrast to other studies which tended to focus on only a subset of the variables examined in this study. Collecting this additional information provided the ability to more accurately discern the individual effects of the variables of interest by controlling for the possible confounding influences of the other variables. This data set indicates that of the three domains of functioning (physical, mental, and social), mental functioning was most significantly related to mortality and institutionalization. Mental functioning was also the primary influence on health perception among those of low mental status. Physical functioning was strongly related to health perception among all the respondents. These findings have important implications for both intervention programs and for further research.

CHAPTER 8

RECOMMENDATIONS

8.0 RECOMMENDATIONS

The following recommendations were suggested based on the results of this study.

8.1 INTERVENTIONS

- *Health promotion programs aimed at increasing function in the older population.* This is consistent with findings from other studies highlighting the importance of physical function in preventing falls resulting in hip fractures. Those in better physical shape are less likely to suffer a hip fracture and more likely to recover in the event of a hip fracture.

- *Programs in institutions aimed at improving or maintaining the physical functioning of residents.* Research shows (Myers, Young, and Langlois) that compared to community residents, residents of institutions are at increased risk of hip fracture and are less likely to recover their physical function following a hip fracture. Improving physical function in this population would likely decrease the risk of falls and therefore decrease hip fractures significantly. Moreover, if an individual should fracture a hip, the chances of recovery would be much improved.

- *Provide transportation and shopping assistance to community residents recovering from a hip fracture.* While this assistance cannot handle all functions of social support, hip fracture patients returning to the community following their fracture often are more dependent than before fracture. It is difficult to maintain appointments and to attend to basic daily needs outside of the home (particularly in the winter). Hip fracture patients tend to be fearful of falling on icy streets.

- *Provide eldercare programs in the workplace.* Eldercare programs allow employees to arrange work time in order to enable them to take elderly parents for dental appointments, medical appointments, or other important activities. Social support is very important in determining whether a person returns to an independent situation following hip fracture. Many hip fracture patients are dependent on adult children, who often are employed outside of the home, for this type of assistance. Conversely, it is important to many adult children to be involved in this way with a parent. This program therefore could benefit both the child and the parent by decreasing both the stress and guilt on both sides.

- *Provide educational opportunities to family members to assist them in understanding hip fracture outcomes and lifestyle options.* Many adult children put pressure on their older relatives to enter institutions because they do not believe it is possible for them to achieve independence following hip fracture. Through education, family members may gain insight into other alternatives open to hip fracture patients.

8.2 SUGGESTIONS FOR FUTURE RESEARCH

While much research has focussed on mortality following hip fracture, research into other outcomes has been more sparse. Institutionalization was not well explained by the model, implying that there are other explanatory variables not included in this analysis. To truly understand the causes of institutionalization, further studies could be undertaken that take the patient's personality, value system, and coping mechanisms into account. While some patients are more resilient and adaptive than others, there also are pressures from outside the patient. The burden and stress of the family and caregivers will influence the decision to enter a long-term care facility. The health care system also has expectations in terms of length of stay in the hospital. Many of these characteristics are very difficult to identify and measure, and perhaps this is why they have been overlooked in past research.

Another area where research is lacking is that of health perception. One area that has been overlooked in previous research is the effect institutionalization has on health perception and quality of life. Research examining the effects of relocation on the frail elderly has been done. However, this research has tended to focus on a particular outcome such as mortality, rather than taking a holistic approach based on individual patient characteristics. As is the case with institutionalization, consideration of causes of health perception should include individual patient characteristics. Related to the problem of examining the determinants of health perception is the difficulty with measurement of health perception among the frail older population. A valid and reliable measure of health perception, (reflecting the personality, beliefs, and health expectations), will aid in any further research. Some research has been done in this area, but no universal measure (applicable to community and institutional populations) of health perception has yet been developed.

In summary, much research into the determinants of outcomes following a hip fracture has been done. Much more research is needed, however, taking into consideration personality factors individual to each patient. The patient's coping mechanisms and the pressures exerted by the family may be important influences in institutionalization and health perception, because these are factors that have been largely overlooked in previous research.

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APPENDIX 1

LETTER TO PATIENT

PATIENT CONSENT FORM

INFORMATION SHEET FOR PATIENTS

Morbidity and Institutionalization after Hip Fracture

Principal Investigator: Dr. Maria Suarez-Almazor
Co-Investigator: Ms. Marilyn Cree

Background: Patients with hip fracture are at increased risk for prolonged disability and may need long-term care. However, not all patients do poorly and many can return to the community and are able to function as before. It is unclear which factors determine if a patient can return to his or her previous health state after a hip fracture. It may be possible to identify these factors. This could lead to a better management of patients with hip fracture. With this knowledge, patients at major risk of disability could be offered different or additional therapies to increase their chances of recovery.

Purpose: Participating in this study will involve four assessments: today and at 3,6 and 12 months following your fracture. At these times you will be required to complete questionnaires regarding your health and your hip fracture, and how they interfere with your daily activities and your quality of life. Each assessment will require approximately forty-five minutes. The follow-up questionnaires can be completed over the phone; personal interviews may be scheduled at your residence if this is your preference.

Possible Benefits: There may not be direct benefits to you for participating in this study. However, it is expected that once the study is complete, the results will help caregivers identify those patients who are at risk of major disability.

Possible Risks: There are no risks involved in this study.

Confidentiality: Personal records relating to the study will be kept confidential. Any report published as a result of this study will not identify you by name.

You are free to withdraw from the research study at any time and your continuing medical care will not be affected in any way. If the study is discontinued at any time, the quality of your medical care will not be affected.

Please contact any of the individuals identified below if you have any questions or concerns.

Ms. Elaine Belseck, BScN - 492-9590
Ms. Marilyn Cree, MSc - 492-9955
Dr. Maria Suarez-Almazor, MD, PhD - 492-9589

If you have further concerns about any aspects of this study you may contact the Patient Concerns office of the Capital Health Authority at 474-8892. This office has no affiliation with the study investigators.

CONSENT FORM

(to be completed by the **research subject**)

Title of Project: Morbidity and Institutionalization after Hip Fracture

Principal Investigator: Dr. Maria Suarez-Almazor (phone: 492-9955)
Co-Investigator: Ms. Marilyn Cree

This study has been explained to me. I understand that participation in this study is voluntary and that refusing to participate will not affect my medical care.

Who explained this study to you? ______________________________

I agree to take part in this study: YES ☐ NO ☐

Signature of Research Subject ______________________________

(Printed Name) ______________________________

Date: ________________

Signature of Witness ______________________________

Signature of Investigator of Designee ______________________

APPENDIX 2

LETTER TO PROXY

PROXY CONSENT FORM

INFORMATION SHEET FOR CARE-GIVERS
Morbidity and Institutionalization after Hip Fracture

Principal Investigator: Dr. Maria Suarez-Almazor
Co-Investigator: Ms. Marilyn Cree

Background: Patients with hip fracture are at increased risk for prolonged disability and may need long-term care. However, not all patients do poorly and many can return to the community and are able to function as before. It is unclear which factors determine if a patient can return to his or her previous health state after a hip fracture. It may be possible to identify these factors. This could lead to a better management of patients with hip fracture. With this knowledge, patients at major risk of disability could be offered different or additional therapies to increase their chances of recovery.

Purpose: You are being asked to give us permission to include this patient in this research study. The purpose of this study is to identify which factors can determine the outcome of patients with hip fracture.

Procedures: Participating in this study will involve four assessments: today and at 3,6 and 12 months following the patient's fracture. At these times the patient or caregiver will be required to complete questionnaires regarding his/her health and hip fracture, and how they interfere with their daily activities and quality of life. Each assessment will require approximately forty-five minutes. The follow-up questionnaires can be completed over the phone; personal interviews may be scheduled at the patient's residence if this is preferred.

Possible Benefits: There may not be direct benefits to the patient for participating in this study. However, it is expected that once the study is complete, the results will help caregivers identify those patients who are at risk of major disability.

Possible Risks: There are no risks involved in this study.

Confidentiality: Personal records relating to the study will be kept confidential. Any report published as a result of this study will not identify this patient by name.

The patient is free to withdraw from the research study at any time and his/her continuing medical care will not be affected in any way. If the study is discontinued at any time, the quality of his/her medical care will not be affected.

Please contact any of the individuals identified below if you have any questions or concerns.

Ms. Elaine Belseck, BScN - 492-9590
Ms. Marilyn Cree, MSc - 492-9955
Dr. Maria Suarez-Almazor, MD, PhD - 492-9589

If you have further concerns about any aspects of this study you may contact the Patient Concerns office of the Capital Health Authority at 474-8892. This office has no affiliation with the study investigators.

CONSENT FORM

(to be completed by the **next-of-kin/caregiver**)

Title of Project: Morbidity and Institutionalization after Hip Fracture

Principal Investigator: Dr. Maria Suarez-Almazor (phone: 492-9955)
Co-Investigator: Ms. Marilyn Cree

This study has been explained to me. I understand that participation in this study is voluntary and that refusing to participate will not affect the medical care of the patient.

Who explained this study to you? ____________________

I give permission on behalf of Mr./Ms. ____________________ for the investigators to obtain the information required for this study. The information will be provided by myself or by other next of kin/caregivers

Signature of Next of Kin ____________________

(Printed Name) ____________________

Date: ____________________

Signature of Witness ____________________

Signature of Investigator of Designee ____________________

APPENDIX 3

DEMOGRAPHIC INFORMATION FORM

PATIENT INFORMATION

Last name: ______________________________First

Name:______________________________

Hosp.ID ______________________________Health Care

Number__________________________

Address:____City/town:_______________

___

Postal Code:____________ Telephone #:________________

Nursing

Home:____

Date of Birth(m/d/y)_________________

Marital Status: ☐ 1 Married ☐2 Single ☐ 3 Widowed ☐ 4 Divorced ☐ 5 Never

Married

Gender (circle one): ☐ 0 Female ☐ 1 Male

Family Doctor________________________

PROXY INFORMATION(If a proxy is interviewed, please complete the following)

Name: ____

Phone #:__________________

Relationship to Patient: ☐ 1 Spouse ☐ 3 Friend

☐ 2 Son/Daughter ☐ 4 Other (please

specify):____________________

CONTACT PERSON:(does not live with person):______________________________

Phone #:__________________

Address____

Date of Hip Fracture(m/d/y)____________________ Which hip was fractured? ☐Left ☐

Right ☐Both

Date of Admission(m/d/y)________________________

Date of Surgery(m/d/y)__________________________

Type of Trauma Sustained

☐ 1 No trauma (sitting, sleeping, etc.)

☐ 2 Trauma - no fall (bumping into something, etc.)

☐ 3 Trauma-from fall (falling from standing, height, etc.) ☐ Inside ☐ Outside ☐ Not specified

☐ 4 Trauma - motor vehicle accident

☐ 5 Other (please specify)______________________________

TYPE OF INTERVIEW

☐Eligible for complete study
  ☐ 1 In person
  ☐ 2 In person/proxy
  ☐ 3 Proxy by interview
  ☐ 4 Proxy by phone
    ☐1 Mini mental
    ☐2 Language
    ☐3 Profoundly deaf
    ☐4

Other____

  ☐ 5 Caregiver by interview

☐ 6 Demographics only
  ☐1 Unable to find a proxy
  ☐2 Patient died
  ☐3 Patient refused
  ☐4 Proxy refused
  ☐5

Other____

Exclusion Criteria

If any of the following conditions apply to the patient then they should be excluded from the study:

1. Re-fracture of the same hip within last 5 years.
2. Chronological age below 65 years old.
3. Fracture as a secondary result of a pathological process excluding osteoporosis (cancer of the bone, Paget's Disease).
4. Admission for late effects of hip fracture or complications of previous fractures.
5. Already included in the study

If the patient is to be excluded then please record their name, ID numbers and reason for exclusion on the Exclusion list.

APPENDIX 4

BARTHEL INDEX

PATIENT____**CASE#:**______________

Date(m/d/y)____________________ **Interviewer**______________________________

We need to ask you some questions about the patient's functional activity now.

If there was no one to help (her or him) with the following, could (,he/she) do it alone?

(If no, could the patient do it with assistance)

Items	**Unable to perform task**	**Needs assistance**	**Fully independent**
Feeding *(includes cutting, spreading butter).*	0	5	10
Personal hygiene*(wash hands and face, shave, brush teeth).*	0	0	5
Bathing Self*(must be able to bath or shower without anyone present).*	0	0	5
Dressing* *(can put on shoes, socks, pants etc. without help).*	0	5	10
Toileting*(can remove clothes, wipe him/herself, get on and off toilet).*	0	5	10
Bowel control*(no accidents day or night).*	0	5	10
Bladder control*(controls bladder day and night).*	0	5	10
Chair/bed transfers*(can safely transfer from a chair to a bed and back again).*	0	5-10	15
Walking** *(walks 50 yards without help or supervision but may use aids).*	0	10	15
Stair Climbing*(goes up and down stairs independently).*	0	5	10
Wheelchair*** *(maneuver corners, position himself near bed, toilet etc.).*	0	0	5

* If patient has special aids that he/she has to wear, he/she must be able to put them on by him/herself or he/she is classified as needing help.

** If the patient is independent with an aid, then patient is independent.

*** Score only if unable to walk.

Notes

- For bowel and bladder control, a patient needs assistance if they have occasional accidents (dribbling, night-time, etc.)
- For chair/bed transfer, a score of 10 is given if patient needs minimal assistance (stand-by) of one and a score of 5 is given for a patient that needs a maximal assistance of 1.
- If patient has not done the activity, score as not applicable(NA).

Information obtained from: ☐1 Physio ☐2Nurse

APPENDIX 5

MINI-MENTAL STATE EXAM

Date(m/d/y)____

MINI MENTAL STATE

What is the date? year? season? day? month? date?

Score(max. 5):____

Where are we? country province? city? hospital? floor?

Score(max.5):_____

I am going to name 3 objects. After I have said all 3 objects, I want you to repeat them. Remember what they are because I am going to ask you to name them again in a few minutes. Name three objects: **BALL,FLAG,TREE.(BELL, JAR, FAN)** One point per correct answer. Repeat until patient gets all three. Up to six trials. Record number of trials ___ **Score** (max.3):____

Begin at 100 and count back by sevens: 93....86..etc. OR

Spell **WORLD.** Now spell it backwards. backwards (1 pt per correct letter) **Score** (max 5):____

What were those 3 objects I named a minute ago? (1 pt. each) **Score** (max.3):_____

Naming: (2 pts) What is this? (watch, pencil) **Score**_____

Repetition: (1 pt) "No ifs, ands, or buts" **Score**_____

Three state command: (3 pts)

"Take the paper in your right hand" "Fold the paper in half. "Put the paper on the floor"

Score_____

Read and obey: (1 pt) Please read and do what this says: **Score**_____

"CLOSE YOUR EYES"

Writing (1 pt) please write a sentence of your choice. **Score**_____

(sentence must contain a subject and a verb- ignore spelling errors)

Copy design: (1 pt) Please copy this design. (attached) **Score**_____

Total Score-(max.30) _____

Total Possible Score______________

Notes: If patient is blind, score out of 27 with 22 being the cut off.
If the patient can not read or write, score out of 22 with 18 being the cut off.

APPENDIX 6

PATIENT BASELINE INTERVIEW FORM

BASELINE INTERVIEW-PATIENT QUESTIONNAIRE

Do you NOW have any of the following conditions?

Blindness or trouble seeing, even when wearing glasses?	Yes 1	No 0	Unknown 9
Deafness or trouble hearing?	Yes 1	No 0	Unknown 9
Arthritis or rheumatism?	Yes 1	No 0	Unknown 9
Sciatica or chronic back problem?	Yes 1	No 0	Unknown 9

Other________________________________

This survey asks for your views about your health before you fractured your hip. During the four weeks immediately prior to your hip fracture, what was your usual level of daily activity?

No activity/ bed-bound	1
Wheelchair	2
Walked with personal assistance	3
Walked with mechanical assistance	4
Walked without assistance	5
Walked a half mile or less outside the home each day	6
Walked vigorously or jogged more than half a mile each day	7

During the four weeks immediately prior to the fracture, how frequently did the hip that was fractured cause you difficulty with the following activities?

	Never	Rarely	Sometimes	Often	Always	Don't do
Stooping or bending	1	2	3	4	5	6
Standing up from a chair	1	2	3	4	5	6
Sitting down in a chair	1	2	3	4	5	6
Climbing a flight of stairs	1	2	3	4	5	6
Walking while outdoors	1	2	3	4	5	6

During the four weeks immediately prior to the fracture, how much pain did you have in the hip that was fractured?

None	1	Moderate	4
Very mild	2	Severe	5
Mild	3	Very severe	6

SF-12 HEALTH SURVEY

This survey asks for your views about your health before your hip fracture. This information will help keep track of how you feel and how well you are able to do your usual activities.

1. In general, would you say your health before the fracture was:

Excellent	Very Good	Good	Fair	Poor
1	2	3	4	5

The following items are about activities you might have done during a typical day before your fracture. Did your health before your fracture limit you in these activities? If so, how much?

	A Lot	A Little	None	Don't do
2. Moderate Activities, such as moving a table or chair, vacuuming, lifting and carrying groceries	1	2	3	4
3. Climbing several flights of stairs	1	2	3	4

During the four weeks before your fracture, did your have any of the following problems with your work or other regular daily activities as a result of your physical health?

	Yes	No
4. Accomplished less than you would like	1	0
5. Were limited in the kind of work or other activities	1	0

During the four weeks before your fracture, did you have any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	Yes	No
6. Accomplished less than you would like	1	0
7. Didn't do work or other activities as carefully as usual	1	0

8. During the four weeks before your fracture, how much did pain interfere with your normal work (including work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely
1	2	3	4	5

These questions are about how you felt and how things have been with you during the four weeks before your fracture. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the four weeks before your fracture:

	All	Most	Good Bit	Some	A Little	None
9. Have you felt calm and peaceful?	1	2	3	4	5	6
10. Did you have a lot of energy?	1	2	3	4	5	6
11. Have you felt downhearted and blue?	1	2	3	4	5	6

12. During the four weeks before your fracture, how much of the time had your physical or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None
1	2	3	4	5

13 How often in the past month have you had difficulty sleeping?

☐1 Not at all
☐2 1-3 nights per week
☐3 Most nights of the week
☐4 Nearly every night for at least 2 weeks

Now I would like to ask you about your functional activity before your hip fracture.

If there was no one to help (him or her) with the following, could you do it alone?
(If no, could you do it with assistance?)

Items	Unable to perform task	Needs assistance	Fully independent
Feeding*(includes cutting, spreading butter).*	0	5	10
Personal hygiene*(wash hands and face, shave, brush teeth).*	0	0	5
Bathing Self *(must be able to bath or shower without anyone present).*	0	0	5
Dressing* *(can put on shoes, socks, pants etc. without help).*	0	5	10
Toileting *(can remove clothes, wipe him/herself, get on and off toilet).*	0	5	10
Bowel control*(no accidents day or night).*	0	5	10
Bladder control*(controls bladder day and night).*	0	5	10
Chair/bed transfers*(can safely transfer from a chair to a bed and back again).*	0	5 -10	15
Walking****(walks 50 yards without help or supervision but may use aids).*	0	10	15
Stair Climbing*(goes up and down stairs independently).*	0	5	10
Wheelchair******(maneuver corners, position himself near bed, toilet etc.).*	0	0	5

* If patient has special aids that he/she has to wear, he/she must be able to put them on by him/herself or he/she is classified as needing help.

** If the patient is independent with an aid, then patient is independent.

*** Score only if unable to walk.

Notes

- For bowel and bladder control, a patient needs assistance if they have occasional accidents (dribbling, night-time, etc.)
- For chair/bed transfer, a score of 10 is given if patient needs minimal assistance (stand-by) of one and a score of 5 is given for a patient that needs a maximal assistance of 1.

☐ 1 Nurse ☐ 3 Proxy
☐ 2 Physio ☐ 4 Patient
☐ 5 Chart

- **Please indicate which statements best describe your own health state before your hip fracture.**

Mobility

1. I had no problems in walking about ☐
2. I had some problems in walking about ☐
3. I was confined to bed ☐

Self-Care

1. I had no problems with self-care ☐
2. I had some problems washing or dressing myself ☐
3. I was unable to wash or dress myself ☐

Usual Activities(work, study, housework, family or leisure activities)

1. I had no problems with performing my usual activities ☐
2. I had some problems with performing my usual activities ☐
3. I was unable to perform my usual activities ☐
4. I have no normal usual activities* ☐

Pain/Discomfort

1. I had no pain or discomfort ☐
2. I had moderate pain or discomfort ☐
3. I had extreme pain or discomfort ☐

Anxiety/Depression

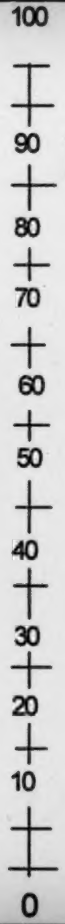
1. I was not anxious or depressed ☐
2. I was moderately anxious or depressed ☐
3. I was extremely anxious or depressed ☐

*This refers to what a healthy individual would consider as usual activities not what the patient usually does for activity.

To help people say how good or bad a health state is, we have drawn a scale (rather like a thermometer) on which the best state you can imagine is marked by 100 and the worst state you can imagine is marked by 0.

We would like you to indicate on this scale how good or bad is your own health today, in your opinion. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your current health state is.

Best imaginable health state



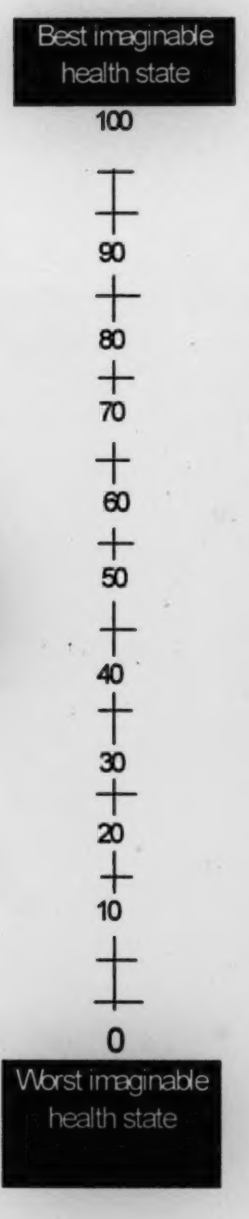
Worst imaginable health state

Your own health state before your hip fracture

To help people say how good or bad a health state is, we have drawn a scale (rather like a thermometer) on which the best state you can imagine is marked by 100 and the worst state you can imagine is marked by 0.

We would like you to indicate on this scale how good or bad is your own health today, in your opinion. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your current health state is.

Your own health state today


Best imaginable health state
100
90
80
70
60
50
40
30
20
10
0
Worst imaginable health state

SOCIAL RESOURCES QUESTIONNAIRE

I would like to ask you some questions about your family and friends.

Are you single, married, never married, widowed, divorced or separated ?

☐1 Single (never married)
☐2 Married
☐3 Widowed
☐4 Divorced
☐5 Separated
☐6 Common law
☐9 Not answered

Who lives with you (you may circle more than one number for this question)

☐Home alone
☐Husband or wife
☐Nursing home/Auxiliary
☐Seniors Home/Apt
☐Parents
☐Grandparents
☐Children
☐Grandchildren
☐Home unspecified
☐Brothers and sisters
☐Friends
☐Other relatives (does not include in-laws covered in the above categories)
☐Non-related paid helper(includes free-room)
☐Other(specify):____________________________

How many people do you know well enough to visit in their homes?

☐3 Five or more
☐2 Three to four
☐1 One or two
☐0 None
☐-9 Don't know
☐9 Not answered

About how many times did you talk to someone - friends, relatives, or others on the telephone in the week before your hip fracture (either you called them or they called you) ? (if subject has no phone, question still applies).

☐3 Once a day or more
☐2 2-6 times
☐1 Once
☐0 Not at all
☐-9 Don't know
☐9 Not answered

How many times during the week before your hip fracture did you spend some time with someone who does not live with you; that is you went to see them or they came to visit you, or you went out to do things together ?

☐3 Once a day or more
☐2 2-6 times
☐1 Once
☐0 Not at all
☐-9 Don't know
☐9 Not answered

Do you have someone you can trust and confide in?

☐1 Yes
☐0 No
☐-9 Don't know
☐9 Not answered

In the weeks before your hip fracture, did you find yourself feeling lonely quite often, sometimes, or almost never?

☐0 Quite often
☐1 Sometimes
☐2 Almost never
☐-9 Don't know
☐9 Not answered

In the weeks before your hip fracture, did you see relatives and friends as often as you want to, or not?

☐1 As often as I want to
☐0 No as often as wants to
☐-9 Don't know
☐9 Not answered

Is there someone who would give you any help at all if you were sick or disabled, for example your husband/wife, a member of your family, or a friend?

☐1 Yes
☐0 No one willing and able to help
☐9 Not answered

if "yes" please answer to a and b questions

a. Is there someone who would take care of you as long as needed, or only for short time, or only someone who would help you now and then (for example, taking you to the doctor, or fixing lunch occasionally,)

☐3 Someone who would take care of subject indefinitely (as long as needed)
☐2 Someone who would take care of subject for a short time (a few weeks to six months)
☐1 Someone who would help the subject now and then (taking him to the doctor or fixing lunch, etc.)
☐-9 Don't know
☐9 Not answered

b. Who is this person?

Name____

Relationship___________________________________

(Code: Spouse=1, Sibling=2, Offspring=3, Grandchild=4, Other Kin=5, Friend=6, Other=7)

What is your highest level of education?

☐1. No Schooling
☐2. Elementary grade_______
☐3. Junior High grade_______
☐4. High School grade_______
☐5. Non-University Degree(Vocational,Technical,Nursing)

____

University

☐6.diploma/certificate
☐7.bachelor's degree
☐9.master's degree
☐10.doctorate
☐8.professional degree (vet, DR, dentist, lawyer)

What was your employment status just before you had your hip fracture?

☐1. Employed full time
☐2. Employed part time
☐3. Unemployed
☐4. Retired
☐5. In school
☐6. Keeping house
☐7. Disability

What kind of work did you normally do? That is, what was your job title?______________________________

What kind of work did your husband/wife normally do? That is, what was (his,her)last job title?____

Which statement better reflects your attitude towards religion:

☐1. Religion is very important to you
☐2. Religion is somewhat important to you
☐3. Religion is not important to you.

How would you describe yourself?

☐1. White (Caucasian)
☐2. Chinese
☐3. South Asian (East Indian, Pakistani, Punjabi, Sri Lankan)
☐4. Arab/West Asian (Armenian, Egyptian, Iranian, Lebanese, Moroccan)
☐5. Filipino
☐6. South East Asian (Cambodian, Indonesian, Laotian, Vietnamese)
☐7. Latin-American
☐8. Korean
☐9. Aboriginal (North American Indian, Metis, Inuit)
☐10. Black
☐11 Other____

APPENDIX 7

PROXY BASELINE INTERVIEW FORM

PROXY INTERVIEW FORM-BASELINE QUESTIONNAIRE

Does HE/SHE have any of the following conditions NOW?

Blindness or trouble seeing, even when wearing glasses?	Yes 1	No 0	Unknown 9
Deafness or trouble hearing?	Yes 1	No 0	Unknown 9
Arthritis or rheumatism?	Yes 1	No 0	Unknown 9
Sciatica or chronic back problem?	Yes 1	No 0	Unknown 9

Other____

This survey asks for your views about HIS/HER health before HE/SHE fractured the hip. During the four weeks immediately prior to the hip fracture, what was HIS/HER usual level of daily activity?

No activity/ bed-bound	1
Wheelchair	2
Walked with personal assistance	3
Walked with mechanical assistance	4
Walked without assistance	5
Walked a half mile or less outside the home each day	6
Walked vigorously or jogged more than half a mile each day	7

During the four weeks immediately prior to the fracture, how frequently did the hip that was fractured cause HIM/HER difficulty with the following activities?

	Never	Rarely	Sometimes	Often	Always	Don't Do	Unknown
a. Stooping or bending	1	2	3	4	5	6	9
b. Standing up from a chair	1	2	3	4	5	6	9
c. Sitting down in a chair	1	2	3	4	5	6	9
d. Climbing a flight of stairs	1	2	3	4	5	6	9
e. Walking while outdoors	1	2	3	4	5	6	9

During the four weeks immediately prior to the fracture, how much pain did HE/SHE have in the hip that was fractured?

None	1	Moderate	4
Very mild	2	Severe	5
Mild	3	Very severe	6

SF-12 HEALTH SURVEY

This survey asks for your views about HIS/HER health before HIS/HER hip fracture. This information will help keep track of how HE/SHE feels and how well HE/SHE is able to do their usual activities.

1. In general, would you say HIS/HER health before the fracture was:

Excellent	Very Good	Good	Fair	Poor
1	2	3	4	5

The following items are about activities HE/SHE might have done during a typical day before HIS/HER fracture. Did HIS/HER health before HIS/HER fracture limit you in these activities? If so, how much?

	A Lot	A Little	None
2. Moderate Activities, such as moving a table or chair, vacuuming, lifting and carrying groceries	1	2	3
3. Climbing several flights of stairs	1	2	3

During the four weeks before HIS/HER fracture, did HE/SHE have any of the following problems with HIS/HER work or other regular daily activities as a result of HIS/HER physical health?

	Yes	No	Don't know
4. Accomplished less than HE/SHE would like	1	0	-9
5. Was limited in the kind of work or other activities	1	0	-9

During the four weeks before HIS/HER fracture, did HE/SHE have any of the following problems with HIS/HER work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	Yes	No	Don't know
6. Accomplished less than HE/SHE would like	1	0	-9
7. Didn't do work or other activities as carefully as usual	1	0	-9

8. During the four weeks before **HIS/HER** fracture, how much did pain interfere with **HIS/HER** normal work

(including work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely
1	2	3	4	5

These questions are about how HE/SHE felt and how things have been with HIM/HER during the four weeks before HIS/HER fracture. For each question, please give the one answer that comes closest to the way HESHE has been feeling. How much of the time during the four weeks before HIS/HER fracture:

	All	Most	Good Bit	Some	A Little	None	Don't know
9. Has HE/SHE felt calm and peaceful?	1	2	3	4	5	6	7
10. Did HE/SHE have a lot of energy?	1	2	3	4	5	6	7
11. Has HE/SHE felt downhearted and blue?	1	2	3	4	5	6	7

12. During the four weeks before **HIS/HER** fracture, how much of the time had **HIS/HER** physical or emotional problems interfered with **HIS/HER** social activities (like visiting friends, relatives, etc.)?

All	Most	Some	A little	None	Don't Know
1	2	3	4	5	6

13 How often in the past month has HE/SHE had difficulty sleeping?

☐1 Not at all
☐2 1-3 nights per week
☐3 Most nights of the week
☐4 Nearly every night for at least 2 weeks

Now I would like to ask you about **HIS/HER** functional activity before **HIS/HER** hip fracture.

If there was no one to help (him or her) with the following, could (he, she) do it alone?
(If no, could (he, she) do it with assistance?)

Items	Unable to perform task	Needs assistance	Fully independent
Feeding*(includes cutting, spreading butter).*	0	5	10
Personal hygiene*(wash hands and face, shave, brush teeth).*	0	0	5
Bathing Self *(must be able to bath or shower without anyone present).*	0	0	5
Dressing* *(can put on shoes, socks, pants etc. without help).*	0	5	10
Toileting *(can remove clothes, wipe him/herself, get on and off toilet).*	0	5	10
Bowel control*(no accidents day or night).*	0	5	10
Bladder control*(controls bladder day and night).*	0	5	10
Chair/bed transfers*(can safely transfer from a chair to a bed and back again).*	0	5 -10	15
Walking***(walks 50 yards without help or supervision but may use aids).*	0	10	15
Stair Climbing*(goes up and down stairs independently).*	0	5	10
Wheelchair****(maneuver corners, position himself near bed, toilet etc.).*	0	0	5

* If patient has special aids that he/she has to wear, he/she must be able to put them on by him/herself or he/she is classified as needing help.

** If the patient is independent with an aid, then patient is independent.

*** Score only if unable to walk.

Notes

- For bowel and bladder control, a patient needs assistance if they have occasional accidents (dribbling, night-time, etc.)
- For chair/bed transfer, a score of 10 is given if patient needs minimal assistance (stand-by) of one and a score of 5 is given for a patient that needs a maximal assistance of 1.

☐ 1 Nurse
☐ 3 Proxy
☐ 2 Physio
☐ 4 Patient
☐ 5 Chart

- **Please indicate which statements best describe HIS/HER own health state before HIS/HER hip fracture.**

Mobility

1. HE/SHE had no problems in walking about ☐
2. HE/SHE had some problems in walking about ☐
3. HE/SHE was confined to bed ☐

Self-Care

1. HE/SHE had no problems with self-care ☐
2. HE/SHE had some problems washing or dressing HIMSELF/HERSELF ☐
3. HE/SHE was unable to wash or dress HIMSELF/HERSELF ☐

Usual Activities(work, study, housework, family or leisure activities)

1. HE/SHE had no problems with performing HIS/HER usual activities ☐
2. HE/SHE had some problems with performing HIS/HER usual activities ☐
3. HE/SHE was unable to perform HIS/HER usual activities ☐
4. HE/SHE has no normal usual activities* ☐

Pain/Discomfort

1. HE/SHE had no pain or discomfort ☐
2. HE/SHE had moderate pain or discomfort ☐
3. HE/SHE had extreme pain or discomfort ☐

Anxiety/Depression

1. HE/SHE was not anxious or depressed ☐
2. HE/SHE was moderately anxious or depressed ☐
3. HE/SHE was extremely anxious or depressed ☐

*This refers to what a healthy individual would consider as usual activities not what the patient usually does for activity.

SOCIAL RESOURCES QUESTIONNAIRE

I would like to ask you some questions about HIS/HER family and friends.

Was HE/SHE single, married, never married, widowed, divorced or separated ?

☐1 Single (never married)
☐2 Married
☐3 Widowed
☐4 Divorced
☐5 Separated
☐6 Common law
☐9 Not answered

Who lives with HIM/HER (you may circle more than one number for this question)

☐Home alone
☐Husband or wife
☐Nursing home/Auxiliary
☐Seniors Home/Apt/Lodge
☐Parents
☐Grandparents
☐Children
☐Grandchildren
☐Home unspecified
☐Brothers and sisters
☐Friends
☐Other relatives (does not include in-laws covered in the above categories)
☐Non-related paid helper(includes free-room)
☐Other(specify):__________________________

How many people does HE/SHE know well enough to visit in their homes?

☐3 Five or more
☐2 Three to four
☐1 One or two
☐0 None
☐-9 Don't know
☐9 Not answered

About how many times did HE/SHE talk to someone - friends, relatives, or others on the telephone in the week before HIS/HER hip fracture (either you called them or they called you) ? (if subject has no phone, question still applies).

☐3 Once a day or more
☐2 2-6 times
☐1 Once
☐0 Not at all
☐-9 Don't know
☐9 Not answered

How many times during the week before HIS/HER hip fracture did HE/SHE spend some time with someone who does not live with HIM/HER; that is HE/SHE went to see them or they came to visit HIM/HER, or THEY went out to do things together ?

☐3 Once a day or more
☐2 2-6 times
☐1 Once
☐0 Not at all
☐-9 Don't know
☐9 Not answered

Did HE/SHE have someone HE/SHE can trust and confide in?

☐1 Yes
☐0 No
☐-9 Don't know
☐9 Not answered

In the weeks before HIS/HER fracture, did HE/SHE find HIMSELF/HERSELF feeling lonely quite often, sometimes, or almost never?

☐0 Quite often
☐1 Sometimes
☐2 Almost never
☐-9 Don't know
☐9 Not answered

In the weeks before HIS/HER hip fracture, did HE/SHE see relatives and friends as often as HE/SHE wants to, or not?

☐1 As often as HE/SHE wants to
☐0 No as often as wants to
☐-9 Don't know
☐9 Not answered

Is there someone who would give HIM/HER any help at all if HE/SHE were sick or disabled, for example HIS/HER husband/wife, a member of HIS/HER family, or a friend?

☐1 Yes
☐0 No one willing and able to help
☐-9 Don't know
☐9 Not answered

If "yes" please answer to a and b questions

a. Is there someone who would take care of HIM/HER as long as needed, or only for short time, or only someone who would help HIM/HER now and then (for example, taking HIM/HER to the doctor, or fixing lunch occasionally,)

☐3 Someone who would take care of subject indefinitely (as long as needed)
☐2 Someone who would take care of subject for a short time (a few weeks to six months)
☐1 Someone who would help the subject now and then (taking him to the doctor or fixing lunch, etc.)
☐-9 Don't know
☐9 Not answered

b. Who is this person?

Name____________________________________

Relationship________________________________

What is HIS/HER highest level of education?

☐1. No Schooling
☐2. Elementary grade_______
☐3. Junior High grade_______
☐4. High School grade_______
☐5. Non-University Degree(Vocational, Technical, Nursing)

____

University

☐6.diploma/certificate
☐7.bachelor's degree
☐8.professional degree (vet, dr, dentist, lawyer)
☐9.master's degree
☐10.doctorate

What was HIS/HER employment status just before HE/SHE had the hip fracture?

☐1. Employed full time
☐2. Employed part time
☐3. Unemployed
☐4. Retired
☐5. In school
☐6. Keeping house
☐7. Disability

What kind of work did HE/SHE normally do? That is, what was your job title?______________________________

What kind of work did **HIS/HER** husband/wife normally do?

____

Which statement better reflects HIS/HER attitude towards religion:

☐1. Religion is very important to HIM/HER
☐2. Religion is somewhat important to HIM/HER
☐3. Religion is not important to HIM/HER

How would you describe him/her?

☐1. White (Caucasian)
☐2. Chinese
☐3. South Asian (East Indian, Pakistani, Punjabi, Sri Lankan)
☐4. Arab/West Asian (Armenian, Egyptian, Iranian, Lebanese, Moroccan)
☐5. Filipino
☐6. South East Asian (Cambodian, Indonesian, Laotian, Vietnamese)
☐7. Latin-American
☐8. Korean
☐9. Aboriginal (North American Indian, Metis, Inuit)
☐10. Black
☐11 Other____

APPENDIX 8

PATIENT THREE-MONTH INTERVIEW FORM

THREE-MONTH PATIENT FOLLOW-UP QUESTIONNAIRE

We need to ask you some questions about your functional activity now.
If there was no one to help (her or him) with the following, could (you, he, she) do it alone?
(If no, could you do it with assistance)

Items	Unable to perform task	Needs assistance	Fully independent
Feeding *(includes cutting, spreading butter).*	0	5	10
Personal hygiene*(wash hands and face, shave, brush teeth).*	0	0	5
Bathing Self*(must be able to bath or shower without anyone present).*	0	0	5
Dressing**(can put on shoes, socks, pants etc. without help).*	0	5	10
Toileting*(can remove clothes, wipe him/herself, get on and off toilet).*	0	5	10
Bowel control*(no accidents day or night).*	0	5	10
Bladder control*(controls bladder day and night).*	0	5	10
Chair/bed transfers*(can safely transfer from a chair to a bed and back again).*	0	5-10	15
Walking***(walks 50 yards without help or supervision but may use aids).*	0	10	15
Stair Climbing*(goes up and down stairs independently).*	0	5	10
Wheelchair****(maneuver corners, position himself near bed, toilet etc.).*	0	0	5

* If patient has special aids that he/she has to wear, he/she must be able to put them on by him/herself or he/she is classified as needing help.
** If the patient is independent with an aid, then patient is independent.
*** Score only if unable to walk.

Notes

- For bowel and bladder control, a patient needs assistance if they have occasional accidents (dribbling, night-time, etc.)
- For chair/bed transfer, a score of 10 is given if patient needs minimal assistance (stand-by) of one and a score of 5 is given for a patient that needs a maximal assistance of 1.
- If patient has not done the activity, score as not applicable(NA).
- Information obtained from:

☐ 1 Patient ☐ 5 Other

Which statements best describe your health state today?

Mobility

1. I have no problems in walking about ☐
2. I have some problems in walking about ☐
3. I was confined to bed ☐

Self-Care

1. I have no problems with self-care ☐
2. I have some problems washing or dressing myself ☐
3. I am unable to wash or dress myself ☐

Usual Activities(work, study, housework, family or leisure activities)

1. I have no problems with performing my usual activities ☐
2. I have some problems with performing my usual activities ☐
3. I am unable to perform my usual activities ☐
4. I have no usual activity* ☐

Pain/Discomfort

1. I have no pain or discomfort ☐
2. I have moderate pain or discomfort ☐
3. I have extreme pain or discomfort ☐

Anxiety/Depression

1. I am not anxious or depressed ☐
2. I am moderately anxious or depressed ☐
3. I am extremely anxious or depressed ☐

*This refers to what a healthy individual would consider as usual activities ant what the patient usually does for activity.

On a scale of 0 to 100, how good do you think your health is today? (0 is the worst health state you can imagine and 100 is the best health sate you can imagine.)______________________________

1. During the past four weeks, what was your usual level of daily activity?

- ☐1 No activity/bed-bound
- ☐2 Wheelchair
- ☐3 Walked with personal assistance
- ☐4 Walked with mechanical assistance
- ☐5 Walked without assistance
- ☐6 Walked a half mile or less outside the home each day
- ☐7 Walked vigorously or jogged more than half a mile each day

2. During the past four weeks, how frequently did the hip that was fractured cause you any difficulty with the following activities?

	Never	Rarely	Sometimes	Often	Always	Don't do
Stooping or bending	1	2	3	4	5	6
Standing up from a chair	1	2	3	4	5	6
Sitting down in a chair	1	2	3	4	5	6
Climbing a flight of stairs	1	2	3	4	5	6
Walking while outdoors	1	2	3	4	5	6

3. During the past four weeks, how much pain did you have in the hip that was fractured?

- ☐1 None
- ☐2 Very mild
- ☐3 Mild
- ☐4 Moderate
- ☐5 Severe
- ☐6 Very severe

SF-12 HEALTH SURVEY

This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to perform your usual activities.

1. In general, would you say your health in the last month was:

Excellent	Very Good	Good	Fair	Poor
1	2	3	4	5

In the past month, did your health limit you in these activities? If so, how much?

	A Lot	A Little	None	Don't do
2. Moderate Activities, such as moving a table or chair, vacuuming, lifting and carrying groceries	1	2	3	4
3. Climbing several flights of stairs	1	2	3	4

4. During the last month, did you accomplish less of your work or other regular daily activities than you would like as a result of your physical health? ☐1 Yes ☐0 No

5. During the last month, were you limited in the kind of work or other activities you could do as a result of your physical health? ☐1 Yes ☐0 No

6. During the last month, did you accomplish less of your work or other regular daily activities than you would like as a result of any emotional problems (such as feeling depressed or anxious)? ☐1 Yes ☐0 No

7. During the last month, you didn't do work or other activities as carefully as usual as a result of any emotional problems (such as felling depressed or anxious?) ?

☐1 Yes ☐0 No

8. During the last month, how much did pain interfere with your normal work (including work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely
1	2	3	4	5

How much of the time during the last month:

	All	Most	Good Bit	Some	A Little	None
9. Have you felt calm and peaceful?	1	2	3	4	5	6
10. Did you have a lot of energy?	1	2	3	4	5	6
11. Have you felt downhearted and blue?	1	2	3	4	5	6

12. During the last month, how much of the time has your physical or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
1	2	3	4	5

13 How often in the past month have you had difficulty sleeping?

- ☐1 Not at all
- ☐2 1-3 nights per week
- ☐3 Most nights of the week
- ☐4 Nearly every night for at least 2 weeks

SOCIAL RESOURCES QUESTIONNAIRE

Has marital status changed? ☐1 Yes ☐0 No

☐1 Single (never married)
☐2 Married
☐3 Widowed
☐4 Divorced
☐5 Separated
☐6 Common law
☐9 Not answered

Who lives with you (you may circle more than one number for this question)

☐Home alone
☐Husband or wife
☐Nursing home/Auxiliary
☐Seniors Home
☐Parents
☐Grandparents
☐Children
☐Grandchildren
☐Home unspecified
☐Brothers and sisters
☐Friends
☐Other relatives (does not include in-laws covered in the above categories)
☐Non-related paid helper(includes free-room)
☐Other(specify):____________________

How many people do you know well enough to visit in their homes?

☐3 Five or more
☐2 Three to four
☐1 One or two
☐0 None
☐-9 Don't know
☐9 Not answered

About how many times did you talk to someone - friends, relatives, or others on the telephone in the last week (either you called them or they called you) ? (if subject has no phone, question still applies).

☐3 Once a day or more
☐2 2-6 times
☐1 Once
☐0 Not at all
☐-9 Don't know
☐9 Not answered

How many times during the last week did you spend some time with someone who does not live with you; that is you went to see them or they came to visit you, or you went out to do things together ?

☐3 Once a day or more
☐2 2-6 times
☐1 Once
☐0 Not at all
☐-9 Don't know
☐9 Not answered

Do you have someone you can trust and confide in?

☐1 Yes
☐0 No
☐-9 Don't know
☐9 Not answered

In the last month, did you find yourself feeling lonely quite often, sometimes, or almost never?

☐0 Quite often
☐1 Sometimes
☐2 Almost never
☐-9 Don't know
☐9 Not answered

In the last month, did you see relatives and friends as often as you want to, or not?

☐1 As often as I want to
☐0 No as often as wants to
☐-9 Don't know
☐9 Not answered

Is there someone who would give you any help at all if you were sick or disabled, for example your husband/wife, a member of your family, or a friend? (If yes, answer questions a and b).

☐1 Yes
☐0 No one willing and able to help
☐-9 Don't know
☐9 Not answered

a. Is there someone who would take care of you as long as needed, or only for short time, or only someone who would help you now and then (for example, taking you to the doctor, or fixing lunch occasionally,)

☐3 Someone who would take care of subject indefinitely (as long as needed)
☐2 Someone who would take care of subject for a short time (a few weeks to six months)
☐1 Someone who would help the subject now and then (taking him to the doctor or fixing lunch, etc.)
☐9 Not answered

b. Who is this person?

Name________________________________

Relationship________________________________

(Code: Spouse=1, Sibling=2, Offspring=3, Grandchild=4, Other Kin=5, Friend=6, Other=7)

Have you had any new health problems since you broke your hip? If yes, please specify.

☐1 Yes ☐0 No

____

____

Have you been admitted to any hospital since you broke your hip? If yes, please specify?

☐1 Yes ☐0 No

When(m/d/y)____

Where____

Why____

APPENDIX 9

PROXY THREE-MONTH INTERVIEW FORM

THREE-MONTH PROXY FOLLOW-UP QUESTIONNAIRE

We need to ask you some questions about **HIS/HER** functional activity now.

If there was no one to help (her or him) with the following, could (he, she) do it alone?

(If no, could he/she do it with assistance)

Items	Unable to perform task	Needs assistance	Fully independent
Feeding *(includes cutting, spreading butter).*	0	5	10
Personal hygiene*(wash hands and face, shave, brush teeth).*	0	0	5
Bathing Self*(must be able to bath or shower without anyone present).*	0	0	5
Dressing**(can put on shoes, socks, pants etc. without help).*	0	5	10
Toileting*(can remove clothes, wipe him/herself, get on and off toilet).*	0	5	10
Bowel control*(no accidents day or night).*	0	5	10
Bladder control*(controls bladder day and night).*	0	5	10
Chair/bed transfers*(can safely transfer from a chair to a bed and back again).*	0	5-10	15
Walking***(walks 50 yards without help or supervision but may use aids).*	0	10	15
Stair Climbing*(goes up and down stairs independently).*	0	5	10
Wheelchair****(maneuver corners, position himself near bed, toilet etc.).*	0	0	5

*If patient has special aids that he/she has to wear, he/she must be able to put them on by him/herself or he/she is classified as needing help.

** If the patient is independent with an aid, then patient is independent.

*** Score only if unable to walk.

Notes

- For bowel and bladder control, a patient needs assistance if they have occasional accidents (dribbling, night-time, etc.)
- For chair/bed transfer, a score of 10 is given if patient needs minimal assistance (stand-by) of one and a score of 5 is given for a patient that needs a maximal assistance of 1.
- If patient has not done the activity, score as not applicable(NA).

Information obtained from:

☐ 3 Nurse ☐ 4 Proxy

Which statements best describes **HIS/HER** health state today?

Mobility

1. HE/SHE has no problems in walking about ☐
2. HE/SHE has some problems in walking about ☐
3. HE/SHE is confined to bed ☐

Self-Care

1. HE/SHE has no problems with self-care ☐
2. HE/SHE has some problems washing or dressing HIMSELF/HERSELF ☐
3. HE/SHE am unable to wash or dress HIMSELF/HERSELF ☐

Usual Activities(work, study, housework, family or leisure activities)

1. HE/SHE has no problems with performing HIS/HER usual activities ☐
2. HE/SHE has some problems with performing HIS/HER usual activities ☐
3. HE/SHE is unable to perform HIS/HER usual activities ☐
4. HE/SHE has no usual activity* ☐

Pain/Discomfort

1. HE/SHE has no pain or discomfort ☐
2. HE/SHE has moderate pain or discomfort ☐
3. HE/SHE has extreme pain or discomfort ☐

Anxiety/Depression

1. HE/SHE is not anxious or depressed ☐
2. HE/SHE is moderately anxious or depressed ☐
3. HE/SHE is extremely anxious or depressed ☐

***This refers to what a healthy individual would consider as usual activities not what the patient does as usual activity.**

1. **During the past four weeks, what was his/her usual level of daily activity?**
   - ☐1 No activity/bed-bound
   - ☐2 Wheelchair
   - ☐3 Walked with personal assistance
   - ☐4 Walked with mechanical assistance
   - ☐5 Walked without assistance
   - ☐6 Walked a half mile or less outside the home each day
   - ☐7 Walked vigorously or jogged more than half a mile each day

2. During the past four weeks, how frequently did the hip that was fractured cause him/her any difficulty with the following activities?

	Never	Rarely	Sometimes	Often	Always	Don't do
Stooping or bending	1	2	3	4	5	6
Standing up from a chair	1	2	3	4	5	6
Sitting down in a chair	1	2	3	4	5	6
Climbing a flight of stairs	1	2	3	4	5	6
Walking while outdoors	1	2	3	4	5	6

3. During the past four weeks, how much pain did he/she have in the hip that was fractured?

☐1	None	☐4	Moderate
☐2	Very mild	☐5	Severe
☐3	Mild	☐6	Very severe

SF-12 HEALTH SURVEY

This survey asks for your views about HIS/HER health. This information will help keep track of how HE/SHE feels and how well HE/SHE is able to perform HIS/HER usual activities.

1. In general, would you say HIS/HER health in the last month was:

Excellent	Very Good	Good	Fair	Poor
1	2	3	4	5

In the past month, did HIS/HER health limit HIM/HER in these activities? If so, how much?

	A Lot	A Little	None	Unknown
2. Moderate Activities, such as moving a table or chair, vacuuming, lifting and carrying groceries	1	2	3	9
3. Climbing several flights of stairs	1	2	3	9

4. During the last month, did HE/SHE accomplish less of HIS/HER work or other regular daily activities than HE/SHE would like as a result of HIS/HER physical health?

☐1 Yes ☐0 No

5. During the last month, were HE/SHE limited in the kind of work or other activities HE/SHE could do as a result of HIS/HER physical health? ☐1 Yes ☐0 No

6. During the last month, did HE/SHE accomplish less of HIS/HER work or other regular daily activities than HE/SHE would like as a result of any emotional problems (such as

feeling depressed or anxious)?

☐1 Yes ☐0 No

7. During the last month, he/she didn't do work or other activities as carefully as usual as a result of any emotional problems (such as feeling depressed or anxious?) ?

☐1 Yes ☐0 No

8. During the last month, how much did pain interfere with HIS/HER normal work (including work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely	Unknown
1	2	3	4	5	9

How much of the time during the last month:

	All	Most	Good Bit	Some	A Little	None	Unknown
9. Has HE/SHE felt calm and peaceful?	1	2	3	4	5	6	9
10. Did HE/SHE have a lot of energy?	1	2	3	4	5	6	9
11. Has HE/SHE felt downhearted and blue?	1	2	3	4	5	6	9

12. During the last month, how much of the time had **HIS/HER** physical or emotional problems interfered with **HIS/HER** social activities (like visiting friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time	Unknown
1	2	3	4	5	9

13 How often in the past month has HE/SHE had difficulty sleeping?

☐1 Not at all
☐2 1-3 nights per week
☐3 Most nights of the week
☐4 Nearly every night for at least 2 weeks

SOCIAL RESOURCES QUESTIONNAIRE

Has marital status changed ? ☐1 Yes ☐0 No

☐1 Single (never married)
☐2 Married
☐3 Widowed
☐4 Divorced
☐5 Separated
☐6 Common law
☐9 Not answered

Who lives with HIM/HER (you may circle more than one number for this question)

☐Home alone
☐Husband or wife
☐Nursing home/Auxiliary
☐Seniors Home/Apt/Lodge
☐Parents
☐Grandparents
☐Children
☐Grandchildren
☐Home unspecified
☐Brothers and sisters
☐Friends
☐Other relatives (does not include in-laws covered in the above categories)
☐Non-related paid helper(includes free-room)
☐Other(specify):____________________________

How many people does HE/SHE know well enough to visit in their homes?

☐3 Five or more
☐2 Three to four
☐1 One or two
☐0 None
☐-9 Unknown
☐9 Not answered

About how many times did HE/SHE talk to someone - friends, relatives, or others on the telephone in the last week (either HE/SHE called them or they called HIM/HER) ? (if subject has no phone, question still applies).

☐3 Once a day or more
☐2 2-6 times
☐1 Once
☐0 Not at all
☐-9 Unknown
☐9 Not answered

How many times during the last week did HE/SHE spend some time with someone who does not live with HIM/HER; that is HE/SHE went to see them or they came to visit HIM/HER, or HE/SHE went out to do things together ?

☐3 Once a day or more
☐2 2-6 times
☐1 Once
☐0 Not at all
☐-9 Unknown
☐9 Not answered

Does HE/SHE have someone HE/SHE can trust and confide in?

☐1 Yes
☐0 No
☐-9 Unknown
☐9 Not answered

In the last month, did HE/SHE find HIMSELF/HERSELF feeling lonely quite often, sometimes, or almost never?

☐0 Quite often
☐1 Sometimes
☐2 Almost never
☐-9 Unknown
☐9 Not answered

In the last month, did HE/SHE see relatives and friends as often as HE/SHE wants to, or not?

☐1 As often as HE/SHE wants to
☐0 No as often as wants to
☐-9 Unknown
☐9 Not answered

Is there someone who would give him/her any help at all if he/she were sick or disabled, for example his/her husband/wife, a family member, or a friend? (If yes, answer questions a and b).

☐1 Yes	☐-9 Don't know
☐0 No one willing and able to help	☐9 Not answered

a. Is there someone who would take care of he/she as long as needed, or only for short time, or only someone who would help him/her now and then (for example, taking him/her to the doctor, or fixing lunch occasionally,)

☐3 Someone who would take care of subject indefinitely (as long as needed)
☐2 Someone who would take care of subject for a short time (a few weeks to six months)
☐1 Someone who would help the subject now and then (taking him to the doctor or fixing lunch, etc.)
☐9 Not answered

b. Who is this person?

Name______________________________
Relationship__________________________
(Code: Spouse=1, Sibling=2, Offspring=3, Grandchild=4, Other Kin=5, Friend=6, Other=7)

Has he/she had any new health problems since he/she broke their hip? If yes, specify. ☐1 Yes ☐0 No

____

____

Has he/she been admitted to any hospital since they broke their hip? If yes, please specify? ☐1 Yes ☐0 No

When(m/d/y)____
Where____
Why____

APPENDIX 10

CHART REVIEW FORM

UNIVERSITY OF ALBERTA HIP FRACTURE STUDY-CHART REVIEW FORM

Patient Name:______________________________ Hosp. ID.No.____________________

Admission date(m/d/y)____________________ Admission time______________

Discharge date(m/d/y)____________________ Discharge time______________

Ht:________________________ Wt:______________________________

Admitted from:

☐1 Home alone
☐2 Home with spouse
☐3 Home with other(s
☐4 Home, unspecified
☐5 Nursing home____
☐6 Rehabilitation facility______________________________________
☐7 Other acute care hospital___________________________________
☐8 Seniors citizens home or lodge_______________________________
☐9 Unknown
☐10 Other(specify____
☐11 Group home____

Discharged to:

☐0 Date of death(m/d/y)______________ Time__________ Cause____________
☐1 Home alone
☐2 Home with spouse
☐3 Home with other(s)
☐4 Home, unspecified
☐5 Nursing home____
☐6 Rehabilitation facility ☐ Glenrose ☐ Grandview ☐ Good Sam ☐ Other__________
☐7 Other acute care hospital___________________________________
☐8 Seniors citizens home or lodge_______________________________
☐9 Unknown
☐10 Other(specify)____
☐11 Group home____

Stability Score_______________

Discharge Diagnosis

______________________________ ___________________________

____

Femoral neck or subcapital:

☐ 1 Impacted
☐ 2 Non-displaced, non-impacted
☐ 3 Displaced
☐ 4 Unknown
☐ Garden_______________

Intertrochanteric

☐ 5 Stable
☐ 6 Unstable
☐ 7 Unknown
☐ 12 Comminuted
☐ 13 Displaced
☐ 14 Impacted

Other

☐ 8 Subtrochanteric

☐ 9 Intertrochanteric/subtrochanteric combination
☐ 10 Unknown
☐ 11 Other (specify)____

Date of surgery:_________________ Hemovac ☐ 1 Yes ☐ 2 No
Surgery start ____________ End _____________ ☐ Spinal ☐ GA ☐________
Surgeon ______________________________

What surgical treatment was used to correct the fracture?

☐ 1 Percutaneous pinning

Internal fixation with:

☐ 2 Multiple pins or screws
☐ 3 Compression screw slide plate
☐ 4 Combination of screws and slide plate
☐ 5 Intramedullary or condylocephalic rods or other devices, such as Zickel Nails, Sampson Fluted rods, Harris Nails, Reconstruction Nails, Enders Nails.
☐ 6 Hemiarthroplasty with a unipolar prosthesis, such as a Moore prosthesis.
☐ 7 Hemiarthroplasty with a bipolar prosthesis
☐ 8 Total hip arthroplasty (replacement of acetabulum and femoral head)
☐ 9 No surgery-traction or bed rest only
☐ 10 Other____

Was methyl methacrylate cement used?	☐ 1 Yes	☐ 2 No
Bone Graft Allograft	☐ 1 Yes	☐ 2 No
Wires	☐ 1 Yes	☐ 2 No

Other surgical intervention at the time of hip surgery____

____

Did the patient ever previously fracture the same hip?

☐ 1 Yes ☐ 2 No When(m/d/y)________________________

Did the patient ever previously fracture the other hip?

☐ 1 Yes ☐ 2 No When(m/d/y)________________________

Goldman Risk Class__________

MEDICAL HISTORY

Conditions now

- ☐Alcoholism(Male ≥4 drinks/day. Female ≥3 drinks/day)
- ☐Blindness/trouble seeing with glasses
- ☐Arthritis/rheumatism
- ☐CHF
- ☐CAD
- ☐Chronic lung disease
- ☐Pulmonary edema
- ☐Diabetes
- ☐Mental illness
- ☐Severe osteoporosis
- ☐Malnutrition
- ☐Hemiplegia/parapelegia
- ☐Hypothyroid
- ☐CRF
- ☐
- ☐Deafness/trouble hearing
- ☐Sciatica/chronic back problems
- ☐Atrial fib
- ☐PVD
- ☐Asthma
- ☐MI within three months
- ☐Ulcer or gastrointestinal bleeding
- ☐Dementia
- ☐Osteoarthritis
- ☐ RA
- ☐ETOH withdrawal/DT'S
- ☐Do not resuscitate
- ☐GERD

Other____

Conditions ever:

- ☐Hypertension or high blood pressure
- ☐Angina
- ☐Kidney disease
- ☐Cancer (not including skin cancer)? ______________________________
- ☐Other ____________________ ____________________
- ☐Stroke
- ☐Myocardial infarction

COMPLICATIONS IN HOSPITAL

☐Hip joint or wound infection	☐Dislocation of hip
☐Loss of reduction-bone complication	☐Loss of reduction-device complication
☐Refracture about device	☐ICU admission
☐Myocardial infarction	☐Stroke
☐Embolism	☐Thrombosis
☐Pneumonia	☐Urinary tract infection
☐Transfusion	
☐Packed cells______________	☐Penta___________________
☐FFP____________________	☐Albumin_________________
☐Platelets________________	☐Other blood_______________
☐Other__________	

Delirium or acute confusion in chart ☐1 Yes ☐0 No

Diagnosed by:

☐1 GAT	☐3 Other physicians________________
☐2 NARG	☐4 Nursing

REHAB IN HOSPITAL

Rehab physio start date(M/D/Y)________________

Weight bearing at discharge

☐1 Feather weight bearing	☐3 Weight bearing as tolerated
☐2 Partial weight bearing	☐4 Other____________________

DIAGNOSTIC TESTS RELATED TO HIP FRACTURE

☐1 CT scan of hip

☐2 Tomograms of hip

☐3 Other____

Trauma

Incident:____

Time of hip fracture:_________________________ Date:____________________

Foley ☐Yes ☐No Date in:__________________ Date out:__________________

APPENDIX 11

LIST OF NURSING HOMES

NURSING HOMES

Central Park Lodge, Lendrum
Extendicare North
Extendicare South
Good Samaritan Mount Pleasant Care Centre
Good Samaritan Southgate Care Centre
Hardisty Nursing Home
Jasper Place Central Park Lodge
Jubilee Lodge Nursing Home
Venta Nursing Home
Youville Nursing Home

AUXILIARY HOSPITALS

Allen Gray Auxiliary Hospital
Capital Care Grandview
Edmonton General Hospital, Long Term Care Program
Good Samaritan Auxiliary Hospital
St. Joseph's Auxiliary Hospital

NURSING HOMES/AUXILIARY HOSPITALS COMBINED

Capital Care Dickensfield
Capital Care Lynnwood
Capital Care Norwood
Mewburn Veterans' Centre
Millwoods Shepherd's Care Centre
St. Michael's Extended Care Centre

DAY HOSPITALS

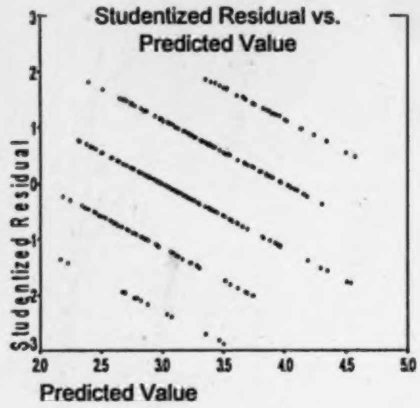
Capital Care Dickensfield
Edmonton General Hospital, Long Term Care Program

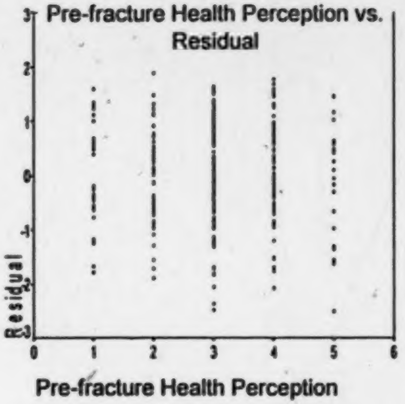
RESIDENTIAL CONTINUING CARE CENTRES

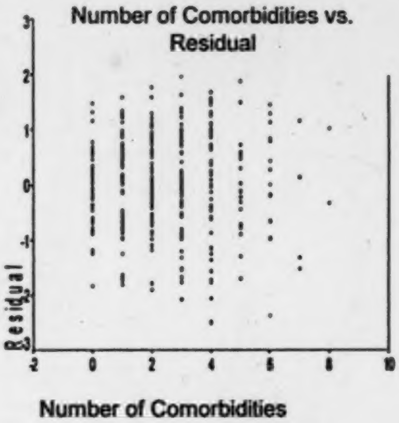
Family Care Homes
Good Samaritan Millwoods Centre
Capital Care Alzheimer Centre
Wedman House

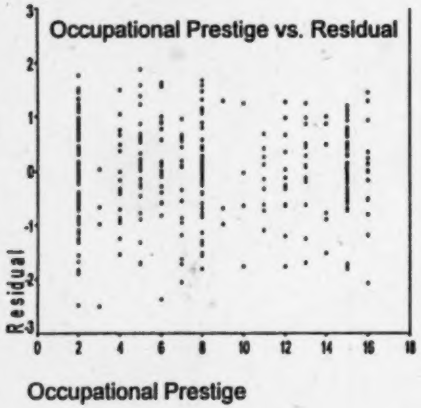
APPENDIX 12

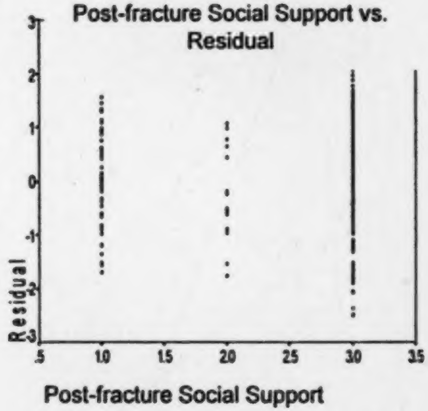
MULTIPLE REGRESSION RESIDUAL PLOTS

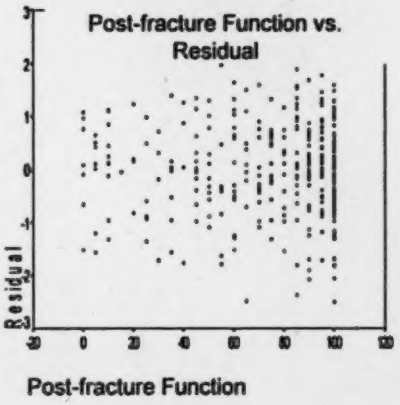

Studentized Residual vs. Predicted Value


Pre-fracture Health Perception vs. Residual


Number of Comorbidities vs. Residual


Occupational Prestige vs. Residual


Post-fracture Social Support vs. Residual


Post-fracture Function vs. Residual

APPENDIX 13

LISREL COMPUTER OUTPUT- PATIENT MODEL

```
 L I S R E L  7.20

                                  BY

                     KARL G JORESKOG AND DAG SORBOM

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 1981-91.
             Partial copyright by Microsoft Corporation, 1984-90.
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 THE FOLLOWING LISREL CONTROL LINES HAVE BEEN READ :


 DA NI=11 NO=222 MA=CM XM=-0.989898D+09
 CM FI=c:\windows\temp\spssb2.tmp FO
 (5E14.6)
 LA
 AGE   PRESTIGE   EDUCATION   COMORBID   MMSE   PRESOCIAL   PREHEALTH
    PRESCORE   POSTSOCIAL   POSTHEALTH   POSTSCORE
 MO NY=11 NE=12 LY=FU,FI BE=FU,FI PS=SY,FI TE=SY,FI
  FR BE(5,1)BE(5,3)
  FR BE(6,1) BE(6,5)
  FR BE (7,1) BE(7,2) BE(7,3) BE(7,4)BE(7,5) BE(7,6) BE(7,8)
  FR BE(8,1) BE(8,2) BE(8,3) BE(8,4) BE(8,5) BE(8,6)
  FR BE(10,1)BE(10,5) BE(10,6)
  FR BE(11,1)BE(11,2) BE(11,4) BE(11,5) BE(11,7) BE(11,9) BE(11,10)
 BE(11,12)
  FR BE(12,1) BE(12,5) BE(12,8) BE(12,10)
  VA 1.0 BE(9,8)
  VA -1.0 BE(9,12)
  FR PS(1,1)
  FR PS(2,1) PS(2,2)
  FR PS(3,1) PS(3,2) PS(3,3)
  FR PS(4,1) PS(4,2) PS(4,3) PS(4,4)
  FR PS(5,5) PS(6,6)PS(7,7) PS(8,8) PS(10,10) PS(11,11) PS(12,12)
  ST 49 PS(1,1)
  ST -6 PS(2,1)
  ST 25 PS(2,2)
  ST -1 PS(3,1)
  ST 5 PS(3,2)
  ST 2 PS(3,3) PS(4,4)
  ST .4 PS(4,1)
  ST -.2 PS(4,2)
  ST -.3 PS(4,3)
  ST 83 PS(5,5)
 ST .6 PS(6,6)
 ST .9 PS(7,7)
 ST 40 PS(8,8)
 ST .4 PS(10,10)
 ST .8 PS(11,11)
 ST 200 PS(12,12)
 VA 1.0 LY(1,1) LY(2,2) LY(3,3) LY(4,4) LY(5,5) LY(6,6) LY(7,7)
VA 1.0 LY(8,8) LY(9,10) LY(10,11) LY(11,12)
 VA 0.24585 TE(1,1)
 VA 2.5313 TE(2,2)
 VA 0.282 TE(3,3)
 VA 0.2593 TE(4,4)
 VA 16.742 TE(5,5)
 VA .00335 TE(6,6)
 VA  .004955 TE(7,7)
 VA 4.0129 TE(8,8)
 VA 0.00219 TE(9,9)
 VA 0.00444 TE(10,10)
 VA 23.7137 TE (11,11)
OU ML AL NS AD=200

UNSPECIFIED TITLE

                         NUMBER OF INPUT VARIABLES 11

                         NUMBER OF Y - VARIABLES   11

                         NUMBER OF X - VARIABLES    0

                         NUMBER OF ETA - VARIABLES 12

                         NUMBER OF KSI - VARIABLES  0

                         NUMBER OF OBSERVATIONS   222

UNSPECIFIED TITLE

        COVARIANCE MATRIX TO BE ANALYZED

               AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
            --------   --------   --------   --------   --------
--------
     AGE    49.170
PRESTIGE    -6.382     25.313
EDUCATIO    -1.231      5.049      2.820
COMORBID      .489      -.200      -.367      2.593
    MMSE    -8.199      5.223      2.366     -1.697     83.710
PRESOCIA     -.421      -.304       .058      -.048       .317
.670
PREHEALT     -.257      -.109      -.301       .622      -.757     -
.102
PRESCORE    -2.199     -1.490      -.058     -2.368      2.067
.412
```

```
POSTSOCI      -.920       .018       .009      -.143       .248
.124
POSTHEAL       .612      -.599      -.297       .474     -1.018      -
.096
POSTSCOR    -21.937     -2.765       .712     -4.933      8.649
.410

        COVARIANCE MATRIX TO BE ANALYZED

           PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR

           ________   ________   ________   ________   ________
PREHEALT       .991
PRESCORE     -1.861     40.129
POSTSOCI      -.012       .348       .438
POSTHEAL       .352     -1.594      -.116       .888
POSTSCOR     -2.699     38.574      1.257     -4.078    237.137

UNSPECIFIED TITLE

PARAMETER SPECIFICATIONS

        LAMBDA Y

              ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6

           ________   ________   ________   ________   ________

________
     AGE          0          0          0          0          0
0
PRESTIGE          0          0          0          0          0
0
EDUCATIO          0          0          0          0          0
0
COMORBID          0          0          0          0          0
0
    MMSE          0          0          0          0          0
0
PRESOCIA          0          0          0          0          0
0
PREHEALT          0          0          0          0          0
0
PRESCORE          0          0          0          0          0
0
POSTSOCI          0          0          0          0          0
0
POSTHEAL          0          0          0          0          0
0
POSTSCOR          0          0          0          0          0
0

        LAMBDA Y

              ETA 7      ETA 8      ETA 9     ETA 10     ETA 11     ETA
12
```

```
                --------  --------  --------  --------  --------
         --------
              AGE         0         0         0         0         0
         0
         PRESTIGE         0         0         0         0         0
         0
         EDUCATIO         0         0         0         0         0
         0
         COMORBID         0         0         0         0         0
         0
             MMSE         0         0         0         0         0
         0
         PRESOCIA         0         0         0         0         0
         0
         PREHEALT         0         0         0         0         0
         0
         PRESCORE         0         0         0         0         0
         0
         POSTSOCI         0         0         0         0         0
         0
         POSTHEAL         0         0         0         0         0
         0
         POSTSCOR         0         0         0         0         0
         0

                 BETA

                      ETA 1     ETA 2     ETA 3     ETA 4     ETA 5       ETA
         6
                   --------  --------  --------  --------  --------
         --------
            ETA 1         0         0         0         0         0
         0
            ETA 2         0         0         0         0         0
         0
            ETA 3         0         0         0         0         0
         0
            ETA 4         0         0         0         0         0
         0
            ETA 5         1         0         2         0         0
         0
            ETA 6         3         0         0         0         4
         0
            ETA 7         5         6         7         8         9
         10
            ETA 8        12        13        14        15        16
         17
            ETA 9         0         0         0         0         0
         0
           ETA 10        18         0         0         0        19
         20
           ETA 11        21        22         0        23        24
         0
```

```
   ETA 12        29          0          0          0         30
0

        BETA

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11       ETA
12
              --------   --------   --------   --------   --------
--------
    ETA 1         0          0          0          0          0
0
    ETA 2         0          0          0          0          0
0
    ETA 3         0          0          0          0          0
0
    ETA 4         0          0          0          0          0
0
    ETA 5         0          0          0          0          0
0
    ETA 6         0          0          0          0          0
0
    ETA 7         0         11          0          0          0
0
    ETA 8         0          0          0          0          0
0
    ETA 9         0          0          0          0          0
0
   ETA 10         0          0          0          0          0
0
   ETA 11        25          0         26         27          0
28
   ETA 12         0         31          0         32          0
0

        PSI

                ETA 1      ETA 2      ETA 3      ETA 4      ETA 5        ETA
6
              --------   --------   --------   --------   --------
--------
    ETA 1        33
    ETA 2        34         35
    ETA 3        36         37         38
    ETA 4        39         40         41         42
    ETA 5         0          0          0          0         43
    ETA 6         0          0          0          0          0
44
    ETA 7         0          0          0          0          0
0
    ETA 8         0          0          0          0          0
0
    ETA 9         0          0          0          0          0
0
```

```
  ETA 10          0          0          0          0          0
0
  ETA 11          0          0          0          0          0
0
  ETA 12          0          0          0          0          0
0

      PSI

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11     ETA
12
           --------   --------   --------   --------   --------
--------
   ETA 7         45
   ETA 8          0         46
   ETA 9          0          0          0
  ETA 10          0          0          0         47
  ETA 11          0          0          0          0         48
  ETA 12          0          0          0          0          0
49

        THETA EPS

                  AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
           --------   --------   --------   --------   --------
--------
     AGE          0
PRESTIGE          0          0
EDUCATIO          0          0          0
COMORBID          0          0          0          0
    MMSE          0          0          0          0          0
PRESOCIA          0          0          0          0          0
0
PREHEALT          0          0          0          0          0
0
PRESCORE          0          0          0          0          0
0
POSTSOCI          0          0          0          0          0
0
POSTHEAL          0          0          0          0          0
0
POSTSCOR          0          0          0          0          0
0

        THETA EPS

             PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
             --------   --------   --------   --------   --------
PREHEALT          0
PRESCORE          0          0
POSTSOCI          0          0          0
POSTHEAL          0          0          0          0
POSTSCOR          0          0          0          0          0
```

```
UNSPECIFIED TITLE

STARTING VALUES

        LAMBDA Y

                 ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
               --------   --------   --------   --------   --------
--------
     AGE         1.000       .000       .000       .000       .000
.000
PRESTIGE          .000      1.000       .000       .000       .000
.000
EDUCATIO          .000       .000      1.000       .000       .000
.000
COMORBID          .000       .000       .000      1.000       .000
.000
    MMSE          .000       .000       .000       .000      1.000
.000
PRESOCIA          .000       .000       .000       .000       .000
1.000
PREHEALT          .000       .000       .000       .000       .000
.000
PRESCORE          .000       .000       .000       .000       .000
.000
POSTSOCI          .000       .000       .000       .000       .000
.000
POSTHEAL          .000       .000       .000       .000       .000
.000
POSTSCOR          .000       .000       .000       .000       .000
.000

        LAMBDA Y

                 ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
               --------   --------   --------   --------   --------
--------
     AGE          .000       .000       .000       .000       .000
.000
PRESTIGE          .000       .000       .000       .000       .000
.000
EDUCATIO          .000       .000       .000       .000       .000
.000
COMORBID          .000       .000       .000       .000       .000
.000
    MMSE          .000       .000       .000       .000       .000
.000
PRESOCIA          .000       .000       .000       .000       .000
.000
PREHEALT         1.000       .000       .000       .000       .000
.000
```

```
PRESCORE        .000      1.000       .000       .000       .000
.000
POSTSOCI        .000       .000       .000      1.000       .000
.000
POSTHEAL        .000       .000       .000       .000      1.000
.000
POSTSCOR        .000       .000       .000       .000       .000
1.000

        BETA

                ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
             --------   --------   --------   --------   --------
--------
   ETA 1        .000       .000       .000       .000       .000
.000
   ETA 2        .000       .000       .000       .000       .000
.000
   ETA 3        .000       .000       .000       .000       .000
.000
   ETA 4        .000       .000       .000       .000       .000
.000
   ETA 5        .000       .000       .000       .000       .000
.000
   ETA 6        .000       .000       .000       .000       .000
.000
   ETA 7        .000       .000       .000       .000       .000
.000
   ETA 8        .000       .000       .000       .000       .000
.000
   ETA 9        .000       .000       .000       .000       .000
.000
  ETA 10        .000       .000       .000       .000       .000
.000
  ETA 11        .000       .000       .000       .000       .000
.000
  ETA 12        .000       .000       .000       .000       .000
.000

        BETA

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
             --------   --------   --------   --------   --------
--------
   ETA 1        .000       .000       .000       .000       .000
.000
   ETA 2        .000       .000       .000       .000       .000
.000
   ETA 3        .000       .000       .000       .000       .000
.000
   ETA 4        .000       .000       .000       .000       .000
.000
```

```
   ETA 5       .000       .000       .000       .000       .000
.000
   ETA 6       .000       .000       .000       .000       .000
.000
   ETA 7       .000       .000       .000       .000       .000
.000
   ETA 8       .000       .000       .000       .000       .000
.000
   ETA 9       .000      1.000       .000       .000       .000      -
1.000
  ETA 10       .000       .000       .000       .000       .000
.000
  ETA 11       .000       .000       .000       .000       .000
.000
  ETA 12       .000       .000       .000       .000       .000
.000

        COVARIANCE MATRIX OF ETA

              ETA 1      ETA 2      ETA 3      ETA 4      ETA 5       ETA
6
            --------   --------   --------   --------   --------
--------
   ETA 1     49.000
   ETA 2     -6.000     25.000
   ETA 3     -1.000      5.000      2.000
   ETA 4       .400      -.200      -.300      2.000
   ETA 5       .000       .000       .000       .000     83.000
   ETA 6       .000       .000       .000       .000       .000
.600
   ETA 7       .000       .000       .000       .000       .000
.000
   ETA 8       .000       .000       .000       .000       .000
.000
   ETA 9       .000       .000       .000       .000       .000
.000
  ETA 10       .000       .000       .000       .000       .000
.000
  ETA 11       .000       .000       .000       .000       .000
.000
  ETA 12       .000       .000       .000       .000       .000
.000

        COVARIANCE MATRIX OF ETA

              ETA 7      ETA 8      ETA 9     ETA 10     ETA 11       ETA
12
            --------   --------   --------   --------   --------
--------
   ETA 7       .900
   ETA 8       .000     40.000
   ETA 9       .000     40.000    240.000
  ETA 10       .000       .000       .000       .400
  ETA 11       .000       .000       .000       .000       .800
  ETA 12       .000       .000   -200.000       .000       .000
200.000

        PSI

                ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
             --------   --------   --------   --------   --------
--------
   ETA 1     49.000
   ETA 2     -6.000     25.000
   ETA 3     -1.000      5.000      2.000
   ETA 4       .400      -.200      -.300      2.000
   ETA 5       .000       .000       .000       .000     83.000
   ETA 6       .000       .000       .000       .000       .000
.600
   ETA 7       .000       .000       .000       .000       .000
.000
   ETA 8       .000       .000       .000       .000       .000
.000
   ETA 9       .000       .000       .000       .000       .000
.000
  ETA 10       .000       .000       .000       .000       .000
.000
  ETA 11       .000       .000       .000       .000       .000
.000
  ETA 12       .000       .000       .000       .000       .000
.000

        PSI

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
             --------   --------   --------   --------   --------
--------
   ETA 7       .900
   ETA 8       .000     40.000
   ETA 9       .000       .000       .000
  ETA 10       .000       .000       .000       .400
  ETA 11       .000       .000       .000       .000       .800
  ETA 12       .000       .000       .000       .000       .000
200.000

        THETA EPS

                  AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
             --------   --------   --------   --------   --------
--------
     AGE       .246
PRESTIGE       .000      2.531
EDUCATIO       .000       .000       .282
COMORBID       .000       .000       .000       .259
    MMSE       .000       .000       .000       .000     16.742
```

```
PRESOCIA       .000       .000       .000       .000       .000
.003
PREHEALT       .000       .000       .000       .000       .000
.000
PRESCORE       .000       .000       .000       .000       .000
.000
POSTSOCI       .000       .000       .000       .000       .000
.000
POSTHEAL       .000       .000       .000       .000       .000
.000
POSTSCOR       .000       .000       .000       .000       .000
.000

        THETA EPS

           PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
           --------   --------   --------   --------   --------
PREHEALT       .005
PRESCORE       .000      4.013
POSTSOCI       .000       .000       .002
POSTHEAL       .000       .000       .000       .004
POSTSCOR       .000       .000       .000       .000     23.714

        SQUARED MULTIPLE CORRELATIONS FOR Y - VARIABLES

                AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
           --------   --------   --------   --------   --------
--------
               .995       .908       .876       .885       .832
.994

        SQUARED MULTIPLE CORRELATIONS FOR Y - VARIABLES

           PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
           --------   --------   --------   --------   --------
               .995       .909       .995       .994       .894

        TOTAL COEFFICIENT OF DETERMINATION FOR Y - VARIABLES IS  1.000

        SQUARED MULTIPLE CORRELATIONS FOR STRUCTURAL EQUATIONS

              ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
           --------   --------   --------   --------   --------
--------
               .000       .000       .000       .000       .000
.000

        SQUARED MULTIPLE CORRELATIONS FOR STRUCTURAL EQUATIONS

              ETA 7      ETA 8      ETA 9     ETA 10     ETA 11     ETA
12
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                ________  ________  ________  ________  ________
________
                  .000      .000     1.000      .000      .000
.000

             BEHAVIOR UNDER STEEPEST DESCENT ITERATIONS


             ITER  TRY   ABSCISSA          SLOPE              FUNCTION

                1    0     .00000000D+00    -.41583236D+02
.57434070D+00
                     1     .10000000D+01     .30899620D+02
.54227264D+02
                     2     .57369754D+00     .43706654D+02
.38897166D+02
                     3     .27970725D+00     .72977932D+02
.22356308D+02
                     4     .10152770D+00     .76964484D+02
.81587349D+01
                     5     .35613089D-01     .87649183D+02
.31763987D+01
                     6     .11459257D-01     .78322279D+02
.86246506D+00
                     7     .39740706D-02     .83520601D+01
.50889311D+00
                     8     .33093769D-02     .21225711D+00
.50603678D+00

                2    0     .00000000D+00    -.11921699D+02
.50603678D+00
                     1     .33093769D-02    -.51089998D+01
.47780324D+00
                     2     .57911549D-02     .81051163D-01
.47155870D+00

                3    0     .00000000D+00    -.11794856D+02
.47155870D+00
                     1     .57911549D-02     .73063119D+01
.45908263D+00
                     2     .35760032D-02     .13976988D+00
.45078497D+00

                4    0     .00000000D+00    -.50797630D+01
.45078497D+00
                     1     .35760032D-02    -.20042547D+01
.43810098D+00
                     2     .59064216D-02     .22501203D-01
.43579008D+00

             BEHAVIOR UNDER MINIMIZATION ITERATIONS

             ITER  TRY   ABSCISSA          SLOPE              FUNCTION
             1    0     .00000000D+00    -.90876268D+00
.43579008D+00
                  1     .10000000D+01     .30870289D+00
.13043445D+00
                  2     .74643809D+00    -.36440330D-02     .91682753D-
01

             2    0     .00000000D+00    -.10041150D+00     .91682753D-
01
                  1     .74643809D+00    -.22471506D-01     .44267834D-
01
                  2     .96164966D+00     .51833829D-02     .42358946D-
01

             3    0     .00000000D+00    -.14344124D-01     .42358946D-
01
                  1     .96164966D+00     .25015702D-02     .36400030D-
01
                  2     .81884557D+00    -.21626419D-03     .36237838D-
01

             4    0     .00000000D+00    -.13465601D-02     .36237838D-
01
                  1     .81884557D+00     .92117505D-04     .35725466D-
01

             5    0     .00000000D+00    -.57044201D-04     .35725466D-
01
                  1     .81884557D+00     .15486447D-05     .35702737D-
01

             6    0     .00000000D+00    -.60744131D-05     .35702737D-
01
                  1     .81884557D+00    -.12194921D-05     .35699750D-
01
                  2     .10245288D+01     .10374198D-08     .35699625D-
01

             7    0     .00000000D+00    -.78416594D-06     .35699625D-
01
                  1     .10245288D+01    -.79976438D-07     .35699182D-
01
                  2     .11408869D+01    -.11570047D-10     .35699178D-
01

             8    0     .00000000D+00    -.71184506D-07     .35699178D-
01
                  1     .11408869D+01     .78940414D-08     .35699141D-
01
                  2     .10269975D+01    -.47935537D-12     .35699141D-
01
```

```
              9     0      .00000000D+00    -.39470002D-08     .35699141D-
01
                    1      .10269975D+01     .11262305D-09     .35699139D-
01

             10     0      .00000000D+00    -.27841909D-09     .35699139D-
01
                    1      .10269975D+01     .54357792D-10     .35699139D-
01
                    2      .85924150D+00    -.14874688D-15     .35699139D-
01

             11     0      .00000000D+00    -.23796121D-10     .35699139D-
01
                    1      .85924150D+00     .12142324D-11     .35699139D-
01

             12     0      .00000000D+00    -.20571859D-11     .35699139D-
01
                    1      .85924150D+00    -.41068356D-12     .35699139D-
01
                    2      .10735603D+01     .32122176D-19     .35699139D-
01

             13     0      .00000000D+00    -.22201990D-12     .35699139D-
01
                    1      .10735603D+01    -.27574759D-13     .35699139D-
01
                    2      .12258046D+01     .42876819D-20     .35699139D-
01

UNSPECIFIED TITLE

LISREL ESTIMATES (MAXIMUM LIKELIHOOD)

        LAMBDA Y

              ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
           --------   --------   --------   --------   --------
--------
     AGE    1.000       .000       .000       .000       .000
.000
PRESTIGE     .000      1.000       .000       .000       .000
.000
EDUCATIO     .000       .000      1.000       .000       .000
.000
COMORBID     .000       .000       .000      1.000       .000
.000
    MMSE     .000       .000       .000       .000      1.000
.000
PRESOCIA     .000       .000       .000       .000       .000
1.000
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```
PREHEALT       .000      .000      .000      .000      .000
.000
PRESCORE       .000      .000      .000      .000      .000
.000
POSTSOCI       .000      .000      .000      .000      .000
.000
POSTHEAL       .000      .000      .000      .000      .000
.000
POSTSCOR       .000      .000      .000      .000      .000
.000

        LAMBDA Y

              ETA 7     ETA 8     ETA 9    ETA 10    ETA 11       ETA
12
            --------  --------  --------  --------  --------

--------
     AGE       .000      .000      .000      .000      .000
.000
PRESTIGE       .000      .000      .000      .000      .000
.000
EDUCATIO       .000      .000      .000      .000      .000
.000
COMORBID       .000      .000      .000      .000      .000
.000
    MMSE       .000      .000      .000      .000      .000
.000
PRESOCIA       .000      .000      .000      .000      .000
.000
PREHEALT      1.000      .000      .000      .000      .000
.000
PRESCORE       .000     1.000      .000      .000      .000
.000
POSTSOCI       .000      .000      .000     1.000      .000
.000
POSTHEAL       .000      .000      .000      .000     1.000
.000
POSTSCOR       .000      .000      .000      .000      .000
1.000

        BETA

              ETA 1     ETA 2     ETA 3     ETA 4     ETA 5       ETA
6
            --------  --------  --------  --------  --------

--------
   ETA 1       .000      .000      .000      .000      .000
.000
   ETA 2       .000      .000      .000      .000      .000
.000
   ETA 3       .000      .000      .000      .000      .000
.000
   ETA 4       .000      .000      .000      .000      .000
.000
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```
   ETA 5      -.146      .000      .876      .000      .000
.000
   ETA 6      -.008      .000      .000      .000      .004
.000
   ETA 7      -.011      .019     -.127      .208     -.003       -
.107
   ETA 8      -.040     -.070     -.068    -1.027      .007
.491
   ETA 9       .000      .000      .000      .000      .000
.000
  ETA 10      -.017      .000      .000      .000      .001
.175
  ETA 11       .000     -.026      .000      .087     -.006
.000
  ETA 12      -.369      .000      .000      .000      .047
.000

        BETA

               ETA 7     ETA 8     ETA 9    ETA 10    ETA 11      ETA
12
             ________  ________  ________  ________  ________
________
   ETA 1       .000      .000      .000      .000      .000
.000
   ETA 2       .000      .000      .000      .000      .000
.000
   ETA 3       .000      .000      .000      .000      .000
.000
   ETA 4       .000      .000      .000      .000      .000
.000
   ETA 5       .000      .000      .000      .000      .000
.000
   ETA 6       .000      .000      .000      .000      .000
.000
   ETA 7       .000     -.037      .000      .000      .000
.000
   ETA 8       .000      .000      .000      .000      .000
.000
   ETA 9       .000     1.000      .000      .000      .000      -
1.000
  ETA 10       .000      .000      .000      .000      .000
.000
  ETA 11       .239      .000     -.014     -.189      .000       -
.024
  ETA 12       .000     1.040      .000     1.290      .000
.000

        COVARIANCE MATRIX OF ETA

               ETA 1     ETA 2     ETA 3     ETA 4     ETA 5      ETA
6
             ________  ________  ________  ________  ________
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```
   ETA 1      48.924
   ETA 2      -6.379      22.779
   ETA 3      -1.231       5.052       2.538
   ETA 4        .492       -.199       -.372       2.333
   ETA 5      -8.200       5.352       2.401       -.398      66.964
   ETA 6       -.421        .072        .019       -.005        .327
.667
   ETA 7       -.256       -.156       -.297        .613       -.469         -
.083
   ETA 8      -2.202      -1.393       -.065      -2.383        .852
.346
   ETA 9      19.733      -2.716       -.599        .308      -6.538         -
.345
  ETA 10       -.920        .126        .026       -.010        .243
.124
  ETA 11        .612       -.687       -.257        .419       -.831         -
.059
  ETA 12     -21.935       1.323        .535      -2.691       7.390
.690

        COVARIANCE MATRIX OF ETA

              ETA 7       ETA 8       ETA 9      ETA 10      ETA 11        ETA
12
            --------    --------    --------    --------    --------
--------
   ETA 7        .980
   ETA 8      -1.856      36.027
   ETA 9        .014      -2.409     171.785
  ETA 10       -.010        .099       -.917        .436
  ETA 11        .341      -1.541       2.186       -.102        .871
  ETA 12      -1.871      38.436    -174.194       1.016      -3.727
212.631

        PSI

              ETA 1       ETA 2       ETA 3       ETA 4       ETA 5        ETA
6
            --------    --------    --------    --------    --------
--------
   ETA 1      48.924
   ETA 2      -6.379      22.779
   ETA 3      -1.231       5.052       2.538
   ETA 4        .492       -.199       -.372       2.333
   ETA 5        .000        .000        .000        .000      63.667
   ETA 6        .000        .000        .000        .000        .000
.662
   ETA 7        .000        .000        .000        .000        .000
.000
   ETA 8        .000        .000        .000        .000        .000
.000
   ETA 9        .000        .000        .000        .000        .000
.000
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  ETA 10       .000       .000       .000       .000       .000
.000
  ETA 11       .000       .000       .000       .000       .000
.000
  ETA 12       .000       .000       .000       .000       .000
.000

        PSI

               ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
            --------   --------   --------   --------   --------
--------
   ETA 7       .736
   ETA 8       .000     33.213
   ETA 9       .000       .000       .000
  ETA 10       .000       .000       .000       .398
  ETA 11       .000       .000       .000       .000       .650
  ETA 12       .000       .000       .000       .000       .000
162.909

        THETA EPS

                 AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
            --------   --------   --------   --------   --------
--------
     AGE       .246
PRESTIGE       .000      2.531
EDUCATIO       .000       .000       .282
COMORBID       .000       .000       .000       .259
    MMSE       .000       .000       .000       .000     16.742
PRESOCIA       .000       .000       .000       .000       .000
.003
PREHEALT       .000       .000       .000       .000       .000
.000
PRESCORE       .000       .000       .000       .000       .000
.000
POSTSOCI       .000       .000       .000       .000       .000
.000
POSTHEAL       .000       .000       .000       .000       .000
.000
POSTSCOR       .000       .000       .000       .000       .000
.000

        THETA EPS

            PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
            --------   --------   --------   --------   --------
PREHEALT       .005
PRESCORE       .000      4.013
POSTSOCI       .000       .000       .002
POSTHEAL       .000       .000       .000       .004
POSTSCOR       .000       .000       .000       .000     23.714
```

```
        SQUARED MULTIPLE CORRELATIONS FOR Y - VARIABLES

                  AGE    PRESTIGE    EDUCATIO    COMORBID        MMSE
PRESOCIA

              ________   ________    ________    ________    ________
________
                  .995       .900        .900        .900        .800
.995

        SQUARED MULTIPLE CORRELATIONS FOR Y - VARIABLES

              PREHEALT   PRESCORE    POSTSOCI    POSTHEAL    POSTSCOR
              ________   ________    ________    ________    ________
                  .995       .900        .995        .995        .900

        TOTAL COEFFICIENT OF DETERMINATION FOR Y - VARIABLES IS  1.000

        SQUARED MULTIPLE CORRELATIONS FOR STRUCTURAL EQUATIONS

                 ETA 1      ETA 2       ETA 3       ETA 4       ETA 5       ETA
6

              ________   ________    ________    ________    ________
________
                  .000       .000        .000        .000        .049
.007

        SQUARED MULTIPLE CORRELATIONS FOR STRUCTURAL EQUATIONS

                 ETA 7      ETA 8       ETA 9      ETA 10      ETA 11       ETA
12

              ________   ________    ________    ________    ________
________
                  .249       .078       1.000        .087        .253
.234

W_A_R_N_I_N_G : LAMBDA Y does not have full column rank

W_A_R_N_I_N_G : PSI is not positive definite


        CHI-SQUARE WITH  17 DEGREES OF FREEDOM =     15.78 (P = .540)

                     GOODNESS OF FIT INDEX = .987
            ADJUSTED GOODNESS OF FIT INDEX = .951
               ROOT MEAN SQUARE RESIDUAL =       .657

UNSPECIFIED TITLE

        FITTED COVARIANCE MATRIX

                  AGE    PRESTIGE    EDUCATIO    COMORBID        MMSE
PRESOCIA
```

```
               ________  ________  ________  ________  ________
     ________
          AGE    49.170
     PRESTIGE    -6.379    25.310
     EDUCATIO    -1.231     5.052     2.820
     COMORBID      .492     -.199     -.372     2.593
         MMSE    -8.200     5.352     2.401     -.398    83.706
     PRESOCIA     -.421      .072      .019     -.005      .327
     .670
     PREHEALT     -.256     -.156     -.297      .613     -.469      -
     .083
     PRESCORE    -2.202    -1.393     -.065    -2.383      .852
     .346
     POSTSOCI     -.920      .126      .026     -.010      .243
     .124
     POSTHEAL      .612     -.687     -.257      .419     -.831      -
     .059
     POSTSCOR   -21.935     1.323      .535    -2.691     7.390
     .690

         FITTED COVARIANCE MATRIX

               PREHEALT  PRESCORE  POSTSOCI  POSTHEAL  POSTSCOR

               ________  ________  ________  ________  ________
     PREHEALT      .985
     PRESCORE    -1.856    40.040
     POSTSOCI     -.010      .099      .438
     POSTHEAL      .341    -1.541     -.102      .875
     POSTSCOR    -1.871    38.436     1.016    -3.727   236.344

         FITTED RESIDUALS

                    AGE  PRESTIGE  EDUCATIO  COMORBID      MMSE
     PRESOCIA

               ________  ________  ________  ________  ________
     ________
          AGE      .000
     PRESTIGE     -.003      .003
     EDUCATIO      .000     -.003      .000
     COMORBID     -.003     -.001      .005      .000
         MMSE      .001     -.129     -.036    -1.300      .004
     PRESOCIA     -.001     -.375      .038     -.043     -.009
     .000
     PREHEALT      .000      .047     -.004      .009     -.289      -
     .019
     PRESCORE      .003     -.097      .007      .015     1.215
     .066
     POSTSOCI      .000     -.108     -.017     -.133      .006
     .000
     POSTHEAL      .000      .088     -.040      .055     -.186      -
     .036
     POSTSCOR     -.003    -4.088      .177    -2.242     1.259      -
     .280
```

```
        FITTED RESIDUALS

           PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
           ________   ________   ________   ________   ________
PREHEALT       .006
PRESCORE      -.005       .089
POSTSOCI      -.002       .249       .000
POSTHEAL       .011      -.053      -.014       .013
POSTSCOR      -.828       .137       .240      -.351       .793

SUMMARY STATISTICS FOR FITTED RESIDUALS
SMALLEST FITTED RESIDUAL =    -4.088
  MEDIAN FITTED RESIDUAL =      .000
 LARGEST FITTED RESIDUAL =     1.259


STEMLEAF PLOT
- 4|1
- 3|
- 2|2
- 1|3
- 0|844332111110000000000000000000000000000000000000
  0|111112228
  1|23

        STANDARDIZED RESIDUALS

                AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
           ________   ________   ________   ________   ________
________
     AGE       .000
PRESTIGE     -1.031       .637
EDUCATIO      -.056      -.370       .292
COMORBID     -2.675      -.585      1.472       .000
    MMSE       .346      -.057      -.409     -1.356       .668
PRESOCIA     -1.340     -1.392       .427      -.486      -.471
.000
PREHEALT      -.799      1.363      -.333       .792     -1.309      -
.867
PRESCORE      1.032      -.586       .124       .282      1.333
.783
POSTSOCI       .439      -.503      -.237     -1.899       .366
.000
POSTHEAL     -1.198      1.287      -.583      2.596     -1.267      -
.788
POSTSCOR      -.374      -.915       .119     -1.583      1.258      -
.386

        STANDARDIZED RESIDUALS

           PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
           ________   ________   ________   ________   ________
```

```
PREHEALT      1.120
PRESCORE      -.160       1.073
POSTSOCI      -.043        .928        .000
POSTHEAL       .904       -.942       -.806      1.423
POSTSCOR      -.975        .320        .956     -1.187       1.197

SUMMARY STATISTICS FOR STANDARDIZED RESIDUALS
SMALLEST STANDARDIZED RESIDUAL =    -2.675
  MEDIAN STANDARDIZED RESIDUAL =     -.049
 LARGEST STANDARDIZED RESIDUAL =     2.596

STEMLEAF PLOT
- 2|7
- 1|96443332200
- 0|999888666555444432211000000
  0|113333444678899
  1|00112333445
  2|6

LARGEST NEGATIVE STANDARDIZED RESIDUALS

RESIDUAL FOR COMORBID AND      AGE =  -2.675

LARGEST POSITIVE STANDARDIZED RESIDUALS

RESIDUAL FOR POSTHEAL AND COMORBID =   2.596

UNSPECIFIED TITLE


                      QPLOT OF STANDARDIZED RESIDUALS


3.5................................................................
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N   .                                               xx
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O   .                                             .*
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R   .                                            *x
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M   .                                         x.*x
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A   .                                       *.x
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L   .                                      *.
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    .                                    *x
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Q   .                                  *.
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U   .                               *xx.
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A   .                              *x.
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N   .                            x*x
.
T   .                          x *.
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I   .                         **.
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L   .                        *x
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E   .                      * .
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S   .                     *.
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    .                    xx
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    .                   .x
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    .                 .x
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    .               x
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3.5.......................................................................
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  -3.5
3.5
                             STANDARDIZED RESIDUALS

UNSPECIFIED TITLE


STANDARD ERRORS

        BETA

                ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
            ________    ________    ________    ________    ________
________
   ETA 1     .000        .000        .000        .000        .000
.000
   ETA 2     .000        .000        .000        .000        .000
.000
   ETA 3     .000        .000        .000        .000        .000
.000
   ETA 4     .000        .000        .000        .000        .000
.000
   ETA 5     .087        .000        .401        .000        .000
.000
   ETA 6     .008        .000        .000        .000        .008
.000
   ETA 7     .009        .019        .058        .043        .008
.073
   ETA 8     .061        .134        .405        .291        .058
.507
   ETA 9     .000        .000        .000        .000        .000
.000
```

```
  ETA 10       .006        .000        .000        .000        .006
.052
  ETA 11       .008        .012        .000        .042        .008
.000
  ETA 12       .138        .000        .000        .000        .129
.000

        BETA

              ETA 7       ETA 8       ETA 9      ETA 10      ETA 11       ETA
12
            --------    --------    --------    --------    --------
--------
   ETA 1       .000        .000        .000        .000        .000
.000
   ETA 2       .000        .000        .000        .000        .000
.000
   ETA 3       .000        .000        .000        .000        .000
.000
   ETA 4       .000        .000        .000        .000        .000
.000
   ETA 5       .000        .000        .000        .000        .000
.000
   ETA 6       .000        .000        .000        .000        .000
.000
   ETA 7       .000        .011        .000        .000        .000
.000
   ETA 8       .000        .000        .000        .000        .000
.000
   ETA 9       .000        .000        .000        .000        .000
.000
  ETA 10       .000        .000        .000        .000        .000
.000
  ETA 11       .064        .000        .012        .085        .000
.010
  ETA 12       .000        .164        .000       1.439        .000
.000

        PSI

              ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
            --------    --------    --------    --------    --------
--------
   ETA 1      4.678
   ETA 2      2.411       2.408
   ETA 3       .796        .662        .268
   ETA 4       .760        .545        .184        .247
   ETA 5       .000        .000        .000        .000       7.669
   ETA 6       .000        .000        .000        .000        .000
.063
   ETA 7       .000        .000        .000        .000        .000
.000
```

```
    ETA 8        .000       .000       .000       .000       .000
 .000
    ETA 9        .000       .000       .000       .000       .000
 .000
   ETA 10        .000       .000       .000       .000       .000
 .000
   ETA 11        .000       .000       .000       .000       .000
 .000
   ETA 12        .000       .000       .000       .000       .000
 .000

          PSI

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
 12
              --------   --------   --------   --------   --------
 --------
    ETA 7        .073
    ETA 8        .000      3.568
    ETA 9        .000       .000       .000
   ETA 10        .000       .000       .000       .038
   ETA 11        .000       .000       .000       .000       .063
   ETA 12        .000       .000       .000       .000       .000
 18.167

 UNSPECIFIED TITLE

          CORRELATIONS OF ESTIMATES

               BE 5,1     BE 5,3     BE 6,1     BE 6,5     BE 7,1      BE
 7,2
              --------   --------   --------   --------   --------
 --------
   BE 5,1       1.000
   BE 5,3        .116      1.000
   BE 6,1       -.009       .000      1.000
   BE 6,5        .000      -.002       .160      1.000
   BE 7,1        .003       .003       .000       .001      1.000
   BE 7,2        .000       .000       .000       .000       .177
 1.000
   BE 7,3        .000      -.002       .000       .000      -.071       -
 .717
   BE 7,4        .000       .000       .000       .000      -.037       -
 .119
   BE 7,5        .003       .022       .000       .000       .136
 .013
   BE 7,6        .000       .000       .002       .007       .061       -
 .003
   BE 7,8        .000       .000       .000       .000       .049
 .042
   BE 8,1       -.002       .000       .000       .000       .017
 .003
   BE 8,2        .000       .000       .000       .000       .001
 .015
```

```
   BE 8,3        .000       -.002        .000        .000        .000      -
 .010
   BE 8,4        .000        .000        .000        .000       -.002      -
 .004
   BE 8,5        .000        .002        .000        .000        .003
 .000
   BE 8,6        .000        .000        .000       -.002        .001
 .000
  BE 10,1       -.002        .000       -.001        .000        .000
 .000
  BE 10,5        .001        .000        .000       -.001        .000
 .000
  BE 10,6        .000        .000        .001       -.002        .000
 .000
  BE 11,1        .013        .002        .000        .000        .007
 .003
  BE 11,2        .001        .010        .000        .000        .002
 .006
  BE 11,4        .000       -.001        .000        .001       -.003      -
 .008
  BE 11,5        .000        .003        .000       -.001        .001
 .001
  BE 11,7        .000       -.001        .000       -.001        .007
 .022
  BE 11,9        .000        .000        .000        .001        .002
 .005
 BE 11,10        .000        .000        .000        .003        .000
 .000
 BE 11,12        .000        .000        .000        .001        .002
 .006
  BE 12,1       -.006        .000        .000        .000       -.012
 .000
  BE 12,5        .001       -.001        .000        .000       -.002
 .000
  BE 12,8        .000        .000        .000        .000       -.001
 .000
 BE 12,10        .000        .000        .000       -.001        .000
 .000
   PS 1,1        .001        .000        .000        .000        .001
 .000
   PS 2,1        .000        .000        .000        .000       -.010
 .000
   PS 2,2        .000        .000        .000        .000        .000      -
 .011
   PS 3,1       -.016        .001        .000        .000        .023
 .000
   PS 3,2        .001       -.009        .000        .000        .000
 .016
   PS 3,3        .000       -.023        .000        .000        .000      -
 .003
   PS 4,1        .000        .000        .000        .000       -.037
 .000
   PS 4,2        .000        .000        .000        .000       -.001      -
 .028
```

```
   PS 4,3       .000      .003      .000      .000      .000
 .003
   PS 4,4       .000      .000      .000      .000      .000
 .000
   PS 5,5      -.002     -.022     -.002     -.012      .001
 .000
   PS 6,6       .000      .000     -.001     -.012      .000
 .000
   PS 7,7       .000      .000      .000      .000      .000      -
 .041
   PS 8,8       .000      .000      .000      .000      .001
 .001
 PS 10,10       .000      .000      .000      .000      .000
 .000
 PS 11,11       .000      .000      .000      .000      .000
 .000
 PS 12,12       .000      .000      .000      .000      .000
 .000

         CORRELATIONS OF ESTIMATES

             BE 7,3    BE 7,4    BE 7,5    BE 7,6    BE 7,8      BE
 8,1
           --------  --------  --------  --------  --------
 --------
   BE 7,3     1.000
   BE 7,4      .203     1.000
   BE 7,5     -.146     -.007     1.000
   BE 7,6      .000     -.021     -.042     1.000
   BE 7,8      .016      .282     -.012     -.073     1.000
   BE 8,1     -.001     -.001      .002      .001     -.001
 1.000
   BE 8,2     -.012     -.011      .001      .002     -.030
 .175
   BE 8,3      .017      .012     -.003     -.002      .032      -
 .071
   BE 8,4      .003      .007      .000      .002     -.031      -
 .053
   BE 8,5     -.003      .001      .018     -.001      .003
 .137
   BE 8,6      .000      .000     -.001      .017      .000
 .065
  BE 10,1      .000      .000      .000      .000      .000
 .000
  BE 10,5      .000      .000      .000      .000      .000
 .000
  BE 10,6      .000      .000      .000      .000      .000
 .000
  BE 11,1     -.002     -.002      .002      .000      .001
 .007
  BE 11,2     -.001     -.001      .000      .000      .001
 .002
  BE 11,4      .007      .012     -.005      .001     -.001
 .001
```

```
  BE 11,5     -.001      -.001       .007       .000       .000
 .001
  BE 11,7     -.018      -.017       .014      -.002       .008
 .000
  BE 11,9     -.004      -.002       .003       .000       .007
 .006
 BE 11,10      .000       .000       .000       .001       .000
 .000
 BE 11,12     -.004      -.002       .003       .000       .008
 .006
  BE 12,1      .000       .000      -.002      -.001      -.001      -
 .047
  BE 12,5      .000       .000      -.013       .000       .000      -
 .008
  BE 12,8      .000       .000       .000       .000      -.012
 .000
 BE 12,10      .000       .000       .000      -.003       .000      -
 .001
   PS 1,1      .000       .000       .000       .000       .000
 .000
   PS 2,1      .000       .000       .000       .000       .000
 .005
   PS 2,2      .001       .000       .000       .000       .000
 .000
   PS 3,1      .000       .000       .000       .000       .000
 .002
   PS 3,2     -.008       .000       .000       .000       .000
 .000
   PS 3,3      .025       .001      -.001       .000       .000
 .000
   PS 4,1      .000       .000       .000       .000       .000
 .026
   PS 4,2      .003      -.010       .000       .000      -.001
 .001
   PS 4,3     -.027       .022       .000       .000       .001
 .000
   PS 4,4     -.001      -.051       .000       .000      -.001
 .000
   PS 5,5     -.001       .000       .004       .000       .000
 .000
   PS 6,6      .000       .000       .000       .000       .000
 .000
   PS 7,7      .046      -.036       .003      -.001       .023
 .000
   PS 8,8      .000       .007       .000      -.002       .024
 .000
 PS 10,10      .000       .000       .000       .000       .000
 .000
 PS 11,11      .000       .000       .000       .000       .000
 .000
 PS 12,12      .000       .000       .000       .000       .000
 .000

         CORRELATIONS OF ESTIMATES
```

	BE 8,2	BE 8,3	BE 8,4	BE 8,5	BE 8,6	BE 10,1
BE 8,2	1.000					
BE 8,3	-.718	1.000				
BE 8,4	-.137	.209	1.000			
BE 8,5	.014	-.145	-.004	1.000		
BE 8,6	.000	.001	.000	-.043	1.000	
BE 10,1	.000	.000	.000	.000	.000	1.000
BE 10,5	.000	.000	.000	.000	.000	.157
BE 10,6	.000	.000	.000	.000	.000	.066
BE 11,1	.002	-.001	-.001	.002	.000	.001
BE 11,2	.007	-.001	-.001	.000	.000	.000
BE 11,4	.005	-.004	.002	.003	.000	.000
BE 11,5	-.001	.000	.000	.007	.000	.000
BE 11,7	.001	-.002	-.001	.001	-.001	.000
BE 11,9	.019	-.016	-.017	.013	.000	.000
BE 11,10	.000	.000	.000	.000	.002	.002
BE 11,12	.021	-.018	-.019	.014	.000	.000
BE 12,1	.000	.000	.001	-.008	-.002	.000
BE 12,5	.000	.000	.000	-.048	.000	.000
BE 12,8	.002	.001	.013	-.006	-.003	.000
BE 12,10	.000	.000	.000	.001	-.011	.000
PS 1,1	.000	.000	.000	.000	.000	.001
PS 2,1	.000	.000	.000	.000	.000	.000
PS 2,2	.006	-.001	.000	.000	.000	.000
PS 3,1	.000	.000	.000	.000	.000	.000
PS 3,2	.001	.003	.000	.000	.000	.000
PS 3,3	.000	.002	.000	.000	.000	.000
PS 4,1	.000	.000	.000	.000	.000	.000

```
   PS 4,2        .020      -.002       .005       .000       .000
.000
   PS 4,3      -.002       .020       .002       .000       .000
.000
   PS 4,4       .000       .001       .037       .000       .000
.000
   PS 5,5       .000       .001       .000      -.004       .000
.000
   PS 6,6       .000       .000       .000       .000       .000
.000
   PS 7,7      -.001       .001      -.001       .000       .000
.000
   PS 8,8       .004       .003       .037      -.004       .000
.000
PS 10,10        .000       .000       .000       .000       .000
.001
PS 11,11        .000       .000       .000       .000       .000
.000
PS 12,12        .000       .000      -.001       .000       .000
.000

           CORRELATIONS OF ESTIMATES

              BE 10,5    BE 10,6    BE 11,1    BE 11,2    BE 11,4    BE
11,5
             --------   --------   --------   --------   --------
--------
 BE 10,5       1.000
 BE 10,6       -.044      1.000
 BE 11,1        .003       .000      1.000
 BE 11,2        .000       .000       .179      1.000
 BE 11,4        .000       .000      -.057       .018      1.000
 BE 11,5        .000       .000       .120      -.129       .000
1.000
 BE 11,7        .000       .000       .092       .050      -.369
.059
 BE 11,9        .000       .000      -.028       .078       .152
.017
BE 11,10        .014       .000       .174       .001      -.012      -
.015
BE 11,12        .000       .000       .058       .086       .167
.004
 BE 12,1       -.001       .000       .017       .000       .000
.002
 BE 12,5        .000       .000       .005       .000       .000
.016
 BE 12,8        .000       .000       .003       .000       .000      -
.001
BE 12,10       -.006       .000       .003       .000       .000
.000
  PS 1,1        .000       .000       .000       .000       .000
.000
  PS 2,1        .000       .000       .014       .000       .000
.000
```

```
  PS 2,2        .000        .000        .000        .022        .000
.000
  PS 3,1        .000        .000        .000        .000        .000
.000
  PS 3,2        .000        .000        .000        .009       -.001
.001
  PS 3,3        .000        .000        .000        .000        .000
.000
  PS 4,1        .000        .000       -.016        .000        .000
.000
  PS 4,2        .000        .000        .000       -.017        .014
.000
  PS 4,3        .000        .000       -.001       -.011        .002       -
.002
  PS 4,4        .000        .000        .000        .000       -.022
.000
  PS 5,5       -.003        .000        .002       -.003        .000
.019
  PS 6,6        .000       -.001        .000        .000        .000
.000
  PS 7,7        .000        .000        .001        .000       -.003
.001
  PS 8,8        .000        .000        .000        .001        .003
.000
PS 10,10       -.002       -.001        .000        .000        .000
.000
PS 11,11        .000        .000        .014        .020       -.023
.016
PS 12,12        .000        .000        .005        .000        .000       -
.001

         CORRELATIONS OF ESTIMATES

             BE 11,7     BE 11,9    BE 11,10    BE 11,12     BE 12,1     BE
12,5
            --------    --------    --------    --------    --------
--------
 BE 11,7       1.000
 BE 11,9        .224       1.000
BE 11,10        .023        .023       1.000
BE 11,12        .246        .918       -.005       1.000
 BE 12,1        .000       -.001        .003        .001       1.000
 BE 12,5        .000       -.006       -.001       -.001        .153
1.000
 BE 12,8        .000        .009       -.001        .015        .049       -
.011
BE 12,10        .000        .000        .017        .000        .194       -
.019
  PS 1,1        .000        .000        .000        .000        .001
.000
  PS 2,1        .000        .000        .000        .000        .000
.000
  PS 2,2        .000        .000        .000        .000        .000
.000
```

```
   PS 3,1        .000        .000        .000        .000        .000
.000
   PS 3,2       -.001        .000        .000        .000        .000
.000
   PS 3,3        .000        .000        .000        .000        .000
.000
   PS 4,1        .000        .000        .000        .000        .000
.000
   PS 4,2       -.001        .000        .000        .000        .000
.000
   PS 4,3        .002        .001        .000        .001        .000
.000
   PS 4,4        .001        .000        .000        .000        .000
.000
   PS 5,5        .001        .000        .000        .000       -.001       -
.009
   PS 6,6        .000        .000        .000        .000        .000
.000
   PS 7,7        .009        .002        .000        .002        .000
.000
   PS 8,8        .000        .009        .000        .010       -.003
.001
 PS 10,10        .000        .000        .001        .000        .000
.000
 PS 11,11        .014        .002       -.001        .013        .000
.000
 PS 12,12        .000       -.011       -.002       -.001       -.003       -
.008

          CORRELATIONS OF ESTIMATES

                BE 12,8    BE 12,10     PS 1,1      PS 2,1      PS 2,2      PS
3,1
               ---------   ---------   ---------   ---------   ---------
 --------
  BE 12,8       1.000
 BE 12,10       -.015       1.000
   PS 1,1        .000        .000       1.000
   PS 2,1        .000        .000       -.252       1.000
   PS 2,2        .000        .000        .033       -.252       1.000
   PS 3,1        .000        .000       -.147        .604       -.152
1.000
   PS 3,2        .000        .000        .023       -.180        .726       -
.208
   PS 3,3        .000        .000        .011       -.087        .358       -
.147
   PS 4,1        .000        .000        .062       -.032        .006       -
.141
   PS 4,2        .000        .000       -.011        .047       -.035
.051
   PS 4,3        .000        .000       -.006        .028       -.021
.057
   PS 4,4        .000        .000        .002       -.001        .001       -
.008
```

```
    PS 5,5      .000       .000       .000       .000       .000
 .000
    PS 6,6      .000       .000       .000       .000       .000
 .000
    PS 7,7      .000       .000       .000       .000       .000
 .000
    PS 8,8     -.066       .001       .000       .000       .000
 .000
 PS 10,10       .000       .000       .000       .000       .000
 .000
 PS 11,11       .000       .000       .000       .000       .000
 .000
 PS 12,12      -.066       .001       .000       .000       .000
 .000

         CORRELATIONS OF ESTIMATES

               PS 3,2     PS 3,3     PS 4,1     PS 4,2     PS 4,3      PS
 4,4
            --------   --------   --------   --------   --------
 --------
    PS 3,2     1.000
    PS 3,3      .726      1.000
    PS 4,1      .024       .020      1.000
    PS 4,2     -.131      -.116      -.182      1.000
    PS 4,3     -.091      -.193      -.109       .596      1.000
    PS 4,4      .004       .019       .062      -.035      -.193
 1.000
    PS 5,5      .000       .000       .000       .000       .000
 .000
    PS 6,6      .000       .000       .000       .000       .000
 .000
    PS 7,7      .000       .001       .000       .001      -.001
 .001
    PS 8,8      .000       .000       .000       .000       .000
 .001
 PS 10,10       .000       .000       .000       .000       .000
 .000
 PS 11,11       .000       .000       .000       .000       .000
 .000
 PS 12,12       .000       .000       .000       .000       .000
 .000

         CORRELATIONS OF ESTIMATES

               PS 5,5     PS 6,6     PS 7,7     PS 8,8    PS 10,10    PS
 11,11
            --------   --------   --------   --------   --------
 --------
    PS 5,5     1.000
    PS 6,6      .000      1.000
    PS 7,7      .000       .000      1.000
    PS 8,8      .000       .000       .000      1.000
 PS 10,10       .000       .000       .000       .000      1.000
```

```
PS 11,11        .000       .000       .000       .000       .000
1.000
PS 12,12        .000       .000       .000       .002       .000
.000

         CORRELATIONS OF ESTIMATES

            PS 12,12
            --------
PS 12,12       1.000

UNSPECIFIED TITLE


T-VALUES

          BETA

               ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
              --------   --------   --------   --------   --------
--------
   ETA 1        .000       .000       .000       .000       .000
.000
   ETA 2        .000       .000       .000       .000       .000
.000
   ETA 3        .000       .000       .000       .000       .000
.000
   ETA 4        .000       .000       .000       .000       .000
.000
   ETA 5      -1.670       .000      2.184       .000       .000
.000
   ETA 6       -.997       .000       .000       .000       .515
.000
   ETA 7      -1.280       .978     -2.185      4.800      -.374      -
1.480
   ETA 8       -.654      -.520      -.167     -3.531       .126
.968
   ETA 9        .000       .000       .000       .000       .000
.000
  ETA 10      -2.775       .000       .000       .000       .112
3.341
  ETA 11       -.048     -2.055       .000      2.045      -.810
.000
  ETA 12      -2.681       .000       .000       .000       .367
.000

          BETA

               ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
              --------   --------   --------   --------   --------
--------
```

```
   ETA 1        .000        .000        .000        .000        .000
.000
   ETA 2        .000        .000        .000        .000        .000
.000
   ETA 3        .000        .000        .000        .000        .000
.000
   ETA 4        .000        .000        .000        .000        .000
.000
   ETA 5        .000        .000        .000        .000        .000
.000
   ETA 6        .000        .000        .000        .000        .000
.000
   ETA 7        .000      -3.404        .000        .000        .000
.000
   ETA 8        .000        .000        .000        .000        .000
.000
   ETA 9        .000        .000        .000        .000        .000
.000
  ETA 10        .000        .000        .000        .000        .000
.000
  ETA 11       3.754        .000      -1.178      -2.215        .000      -
2.342
  ETA 12        .000       6.354        .000        .896        .000
.000

        PSI

               ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
            --------    --------    --------    --------    --------
--------
   ETA 1      10.459
   ETA 2      -2.645       9.461
   ETA 3      -1.546       7.631       9.461
   ETA 4        .648       -.366      -2.028       9.461
   ETA 5        .000        .000        .000        .000       8.302
   ETA 6        .000        .000        .000        .000        .000
10.455
   ETA 7        .000        .000        .000        .000        .000
.000
   ETA 8        .000        .000        .000        .000        .000
.000
   ETA 9        .000        .000        .000        .000        .000
.000
  ETA 10        .000        .000        .000        .000        .000
.000
  ETA 11        .000        .000        .000        .000        .000
.000
  ETA 12        .000        .000        .000        .000        .000
.000

        PSI
```

```
                 ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
               --------   --------   --------   --------   --------
 --------
     ETA 7     10.138
     ETA 8       .000      9.308
     ETA 9       .000       .000       .000
    ETA 10       .000       .000       .000     10.450
    ETA 11       .000       .000       .000       .000     10.317
    ETA 12       .000       .000       .000       .000       .000
8.968

UNSPECIFIED TITLE


TOTAL AND INDIRECT EFFECTS

        TOTAL EFFECTS OF ETA ON  ETA

                 ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
               --------   --------   --------   --------   --------
 --------
     ETA 1       .000       .000       .000       .000       .000
.000
     ETA 2       .000       .000       .000       .000       .000
.000
     ETA 3       .000       .000       .000       .000       .000
.000
     ETA 4       .000       .000       .000       .000       .000
.000
     ETA 5      -.146       .000       .876       .000       .000
.000
     ETA 6      -.009       .000       .003       .000       .004
.000
     ETA 7      -.008       .021      -.127       .246      -.004       -
.125
     ETA 8      -.045      -.070      -.060     -1.027       .009
.491
     ETA 9       .402       .003      -.041       .041      -.049       -
.246
    ETA 10      -.019       .000       .001       .000       .001
.175
    ETA 11       .007      -.019      -.035       .171      -.008       -
.078
    ETA 12      -.448      -.072      -.019     -1.068       .059
.736

        TOTAL EFFECTS OF ETA ON  ETA

                 ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
               --------   --------   --------   --------   --------
 --------
```

```
   ETA 1      .000       .000       .000       .000       .000
.000
   ETA 2      .000       .000       .000       .000       .000
.000
   ETA 3      .000       .000       .000       .000       .000
.000
   ETA 4      .000       .000       .000       .000       .000
.000
   ETA 5      .000       .000       .000       .000       .000
.000
   ETA 6      .000       .000       .000       .000       .000
.000
   ETA 7      .000      -.037       .000       .000       .000
.000
   ETA 8      .000       .000       .000       .000       .000
.000
   ETA 9      .000      -.040       .000     -1.290       .000      -
1.000
  ETA 10      .000       .000       .000       .000       .000
.000
  ETA 11      .239      -.034      -.014      -.202       .000      -
.011
  ETA 12      .000      1.040       .000      1.290       .000
.000

   LARGEST EIGENVALUE OF B*B' (STABILITY INDEX) IS   3.583

         STANDARD ERRORS FOR TOTAL EFFECTS OF ETA ON  ETA

             ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
          --------   --------   --------   --------   --------

--------
   ETA 1      .000       .000       .000       .000       .000
.000
   ETA 2      .000       .000       .000       .000       .000
.000
   ETA 3      .000       .000       .000       .000       .000
.000
   ETA 4      .000       .000       .000       .000       .000
.000
   ETA 5      .087       .000       .401       .000       .000
.000
   ETA 6      .008       .000       .007       .000       .008
.000
   ETA 7      .009       .020       .059       .043       .009
.074
   ETA 8      .061       .134       .401       .291       .058
.507
   ETA 9      .133       .013       .116       .168       .129
.273
  ETA 10      .006       .000       .005       .000       .006
.052
```

```
   ETA 11      .009       .014       .022       .040       .008
.031
   ETA 12      .145       .140       .432       .344       .140
.591

         STANDARD ERRORS FOR TOTAL EFFECTS OF ETA ON  ETA

               ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
              --------   --------   --------   --------   --------
--------
    ETA 1      .000       .000       .000       .000       .000
.000
    ETA 2      .000       .000       .000       .000       .000
.000
    ETA 3      .000       .000       .000       .000       .000
.000
    ETA 4      .000       .000       .000       .000       .000
.000
    ETA 5      .000       .000       .000       .000       .000
.000
    ETA 6      .000       .000       .000       .000       .000
.000
    ETA 7      .000       .011       .000       .000       .000
.000
    ETA 8      .000       .000       .000       .000       .000
.000
    ETA 9      .000       .164       .000      1.439       .000
.000
   ETA 10      .000       .000       .000       .000       .000
.000
   ETA 11      .064       .011       .012       .086       .000
.005
   ETA 12      .000       .164       .000      1.439       .000
.000

         INDIRECT EFFECTS OF ETA ON  ETA

               ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
              --------   --------   --------   --------   --------
--------
    ETA 1      .000       .000       .000       .000       .000
.000
    ETA 2      .000       .000       .000       .000       .000
.000
    ETA 3      .000       .000       .000       .000       .000
.000
    ETA 4      .000       .000       .000       .000       .000
.000
    ETA 5      .000       .000       .000       .000       .000
.000
    ETA 6     -.001       .000       .003       .000       .000
.000
```

```
     ETA 7      .003      .003     -.001      .038     -.001       -
 .018
     ETA 8     -.005      .000      .008      .000      .002
 .000
     ETA 9      .402      .003     -.041      .041     -.049       -
 .246
    ETA 10     -.002      .000      .001      .000      .001
 .000
    ETA 11      .008      .007     -.035      .084     -.002       -
 .078
    ETA 12     -.078     -.072     -.019    -1.068      .011
 .736

          INDIRECT EFFECTS OF ETA ON  ETA

               ETA 7     ETA 8     ETA 9    ETA 10    ETA 11      ETA
 12
             --------  --------  --------  --------  --------
 --------
     ETA 1      .000      .000      .000      .000      .000
 .000
     ETA 2      .000      .000      .000      .000      .000
 .000
     ETA 3      .000      .000      .000      .000      .000
 .000
     ETA 4      .000      .000      .000      .000      .000
 .000
     ETA 5      .000      .000      .000      .000      .000
 .000
     ETA 6      .000      .000      .000      .000      .000
 .000
     ETA 7      .000      .000      .000      .000      .000
 .000
     ETA 8      .000      .000      .000      .000      .000
 .000
     ETA 9      .000    -1.040      .000    -1.290      .000
 .000
    ETA 10      .000      .000      .000      .000      .000
 .000
    ETA 11      .000     -.034      .000     -.014      .000
 .014
    ETA 12      .000      .000      .000      .000      .000
 .000

          STANDARD ERRORS FOR INDIRECT EFFECTS OF ETA ON  ETA

               ETA 1     ETA 2     ETA 3     ETA 4     ETA 5      ETA
 6
             --------  --------  --------  --------  --------
 --------
     ETA 1      .000      .000      .000      .000      .000
 .000
     ETA 2      .000      .000      .000      .000      .000
 .000
```

```
    ETA 3       .000       .000       .000       .000       .000
 .000
    ETA 4       .000       .000       .000       .000       .000
 .000
    ETA 5       .000       .000       .000       .000       .000
 .000
    ETA 6       .001       .000       .007       .000       .000
 .000
    ETA 7       .003       .005       .017       .015       .002
 .019
    ETA 8       .010       .000       .051       .000       .004
 .000
    ETA 9       .133       .013       .116       .168       .129
 .273
   ETA 10       .002       .000       .005       .000       .001
 .000
   ETA 11       .004       .007       .022       .021       .003
 .031
   ETA 12       .072       .140       .432       .344       .061
 .591

     STANDARD ERRORS FOR INDIRECT EFFECTS OF ETA ON  ETA

               ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
 12
             ________   ________   ________   ________   ________
 ________
    ETA 1       .000       .000       .000       .000       .000
 .000
    ETA 2       .000       .000       .000       .000       .000
 .000
    ETA 3       .000       .000       .000       .000       .000
 .000
    ETA 4       .000       .000       .000       .000       .000
 .000
    ETA 5       .000       .000       .000       .000       .000
 .000
    ETA 6       .000       .000       .000       .000       .000
 .000
    ETA 7       .000       .000       .000       .000       .000
 .000
    ETA 8       .000       .000       .000       .000       .000
 .000
    ETA 9       .000       .164       .000      1.439       .000
 .000
   ETA 10       .000       .000       .000       .000       .000
 .000
   ETA 11       .000       .011       .000       .016       .000
 .012
   ETA 12       .000       .000       .000       .000       .000
 .000

     TOTAL EFFECTS OF ETA ON  Y
```

```
                 ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
 6
               --------   --------   --------   --------   --------
 --------
      AGE       1.000       .000       .000       .000       .000
 .000
 PRESTIGE        .000      1.000       .000       .000       .000
 .000
 EDUCATIO        .000       .000      1.000       .000       .000
 .000
 COMORBID        .000       .000       .000      1.000       .000
 .000
     MMSE       -.146       .000       .876       .000      1.000
 .000
 PRESOCIA       -.009       .000       .003       .000       .004
 1.000
 PREHEALT       -.008       .021      -.127       .246      -.004      -
 .125
 PRESCORE       -.045      -.070      -.060     -1.027       .009
 .491
 POSTSOCI       -.019       .000       .001       .000       .001
 .175
 POSTHEAL        .007      -.019      -.035       .171      -.008      -
 .078
 POSTSCOR       -.448      -.072      -.019     -1.068       .059
 .736

          TOTAL EFFECTS OF ETA ON  Y

                 ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
 12
               --------   --------   --------   --------   --------
 --------
      AGE        .000       .000       .000       .000       .000
 .000
 PRESTIGE        .000       .000       .000       .000       .000
 .000
 EDUCATIO        .000       .000       .000       .000       .000
 .000
 COMORBID        .000       .000       .000       .000       .000
 .000
     MMSE        .000       .000       .000       .000       .000
 .000
 PRESOCIA        .000       .000       .000       .000       .000
 .000
 PREHEALT       1.000      -.037       .000       .000       .000
 .000
 PRESCORE        .000      1.000       .000       .000       .000
 .000
 POSTSOCI        .000       .000       .000      1.000       .000
 .000
 POSTHEAL        .239      -.034      -.014      -.202      1.000      -
 .011
```

```
POSTSCOR       .000     1.040      .000     1.290      .000
1.000

       STANDARD ERRORS FOR TOTAL EFFECTS OF ETA ON  Y

              ETA 1     ETA 2     ETA 3     ETA 4     ETA 5     ETA
6
              ________  ________  ________  ________  ________
________
     AGE       .000      .000      .000      .000      .000
.000
PRESTIGE       .000      .000      .000      .000      .000
.000
EDUCATIO       .000      .000      .000      .000      .000
.000
COMORBID       .000      .000      .000      .000      .000
.000
    MMSE       .087      .000      .401      .000      .000
.000
PRESOCIA       .008      .000      .007      .000      .008
.000
PREHEALT       .009      .020      .059      .043      .009
.074
PRESCORE       .061      .134      .401      .291      .058
.507
POSTSOCI       .006      .000      .005      .000      .006
.052
POSTHEAL       .009      .014      .022      .040      .008
.031
POSTSCOR       .145      .140      .432      .344      .140
.591

       STANDARD ERRORS FOR TOTAL EFFECTS OF ETA ON  Y

              ETA 7     ETA 8     ETA 9     ETA 10    ETA 11    ETA
12
              ________  ________  ________  ________  ________
________
     AGE       .000      .000      .000      .000      .000
.000
PRESTIGE       .000      .000      .000      .000      .000
.000
EDUCATIO       .000      .000      .000      .000      .000
.000
COMORBID       .000      .000      .000      .000      .000
.000
    MMSE       .000      .000      .000      .000      .000
.000
PRESOCIA       .000      .000      .000      .000      .000
.000
PREHEALT       .000      .011      .000      .000      .000
.000
PRESCORE       .000      .000      .000      .000      .000
.000
```

```
 POSTSOCI       .000       .000       .000       .000       .000
 .000
 POSTHEAL       .064       .011       .012       .086       .000
 .005
 POSTSCOR       .000       .164       .000      1.439       .000
 .000

         INDIRECT EFFECTS OF ETA ON  Y

                ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
 6
             --------   --------   --------   --------   --------
 --------
      AGE       .000       .000       .000       .000       .000
 .000
 PRESTIGE       .000       .000       .000       .000       .000
 .000
 EDUCATIO       .000       .000       .000       .000       .000
 .000
 COMORBID       .000       .000       .000       .000       .000
 .000
     MMSE      -.146       .000       .876       .000       .000
 .000
 PRESOCIA      -.009       .000       .003       .000       .004
 .000
 PREHEALT      -.008       .021      -.127       .246      -.004      -
 .125
 PRESCORE      -.045      -.070      -.060     -1.027       .009
 .491
 POSTSOCI      -.019       .000       .001       .000       .001
 .175
 POSTHEAL       .007      -.019      -.035       .171      -.008      -
 .078
 POSTSCOR      -.448      -.072      -.019     -1.068       .059
 .736

         INDIRECT EFFECTS OF ETA ON  Y

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
 12
             --------   --------   --------   --------   --------
 --------
      AGE       .000       .000       .000       .000       .000
 .000
 PRESTIGE       .000       .000       .000       .000       .000
 .000
 EDUCATIO       .000       .000       .000       .000       .000
 .000
 COMORBID       .000       .000       .000       .000       .000
 .000
     MMSE       .000       .000       .000       .000       .000
 .000
 PRESOCIA       .000       .000       .000       .000       .000
 .000
```

```
PREHEALT       .000      -.037       .000       .000       .000
.000
PRESCORE       .000       .000       .000       .000       .000
.000
POSTSOCI       .000       .000       .000       .000       .000
.000
POSTHEAL       .239      -.034      -.014      -.202       .000      -
.011
POSTSCOR       .000      1.040       .000      1.290       .000
.000

         STANDARD ERRORS FOR INDIRECT EFFECTS OF ETA ON  Y

             ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
           --------   --------   --------   --------   --------
--------
     AGE       .000       .000       .000       .000       .000
.000
PRESTIGE       .000       .000       .000       .000       .000
.000
EDUCATIO       .000       .000       .000       .000       .000
.000
COMORBID       .000       .000       .000       .000       .000
.000
    MMSE       .087       .000       .401       .000       .000
.000
PRESOCIA       .008       .000       .007       .000       .008
.000
PREHEALT       .009       .020       .059       .043       .009
.074
PRESCORE       .061       .134       .401       .291       .058
.507
POSTSOCI       .006       .000       .005       .000       .006
.052
POSTHEAL       .009       .014       .022       .040       .008
.031
POSTSCOR       .145       .140       .432       .344       .140
.591

         STANDARD ERRORS FOR INDIRECT EFFECTS OF ETA ON  Y

             ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
           --------   --------   --------   --------   --------
--------
     AGE       .000       .000       .000       .000       .000
.000
PRESTIGE       .000       .000       .000       .000       .000
.000
EDUCATIO       .000       .000       .000       .000       .000
.000
COMORBID       .000       .000       .000       .000       .000
.000
```

```
        MMSE      .000      .000      .000      .000      .000
    .000
    PRESOCIA      .000      .000      .000      .000      .000
    .000
    PREHEALT      .000      .011      .000      .000      .000
    .000
    PRESCORE      .000      .000      .000      .000      .000
    .000
    POSTSOCI      .000      .000      .000      .000      .000
    .000
    POSTHEAL      .064      .011      .012      .086      .000
    .005
    POSTSCOR      .000      .164      .000     1.439      .000
    .000

    UNSPECIFIED TITLE


    COVARIANCES

            Y - ETA

                   AGE  PRESTIGE  EDUCATIO  COMORBID      MMSE
    PRESOCIA
              --------  --------  --------  --------  --------
    --------
       ETA 1    48.924    -6.379    -1.231      .492    -8.200       -
    .421
       ETA 2    -6.379    22.779     5.052     -.199     5.352
    .072
       ETA 3    -1.231     5.052     2.538     -.372     2.401
    .019
       ETA 4      .492     -.199     -.372     2.333     -.398       -
    .005
       ETA 5    -8.200     5.352     2.401     -.398    66.964
    .327
       ETA 6     -.421      .072      .019     -.005      .327
    .667
       ETA 7     -.256     -.156     -.297      .613     -.469       -
    .083
       ETA 8    -2.202    -1.393     -.065    -2.383      .852
    .346
       ETA 9    19.733    -2.716     -.599      .308    -6.538       -
    .345
      ETA 10     -.920      .126      .026     -.010      .243
    .124
      ETA 11      .612     -.687     -.257      .419     -.831       -
    .059
      ETA 12   -21.935     1.323      .535    -2.691     7.390
    .690

            Y - ETA

              PREHEALT  PRESCORE  POSTSOCI  POSTHEAL  POSTSCOR
```

```
          ________    ________    ________    ________    ________
   ETA 1     -.256      -2.202       -.920        .612     -21.935
   ETA 2     -.156      -1.393        .126       -.687       1.323
   ETA 3     -.297       -.065        .026       -.257        .535
   ETA 4      .613      -2.383       -.010        .419      -2.691
   ETA 5     -.469        .852        .243       -.831       7.390
   ETA 6     -.083        .346        .124       -.059        .690
   ETA 7      .980      -1.856       -.010        .341      -1.871
   ETA 8    -1.856      36.027        .099      -1.541      38.436
   ETA 9      .014      -2.409       -.917       2.186    -174.194
  ETA 10     -.010        .099        .436       -.102       1.016
  ETA 11      .341      -1.541       -.102        .871      -3.727
  ETA 12    -1.871      38.436       1.016      -3.727     212.631

UNSPECIFIED TITLE


FIRST ORDER DERIVATIVES

        LAMBDA Y

             ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
          ________    ________    ________    ________    ________
________
     AGE      .000        .012        .000        .011       -.003
.003
PRESTIGE      .000        .000        .001        .000       -.006
.029
EDUCATIO      .000       -.002        .000       -.013        .070        -
.060
COMORBID      .000        .000       -.004        .000        .412
.005
    MMSE      .000        .000        .000        .014        .000
.001
PRESOCIA      .000        .434       -.041        .009        .000
.000
PREHEALT      .000        .000       -.012        .000        .000        -
.014
PRESCORE      .000       -.018        .001       -.010        .000        -
.001
POSTSOCI      .000        .093        .060        .263        .000
.008
POSTHEAL      .000        .000        .051        .000        .000
.057
POSTSCOR      .000        .017        .000        .010        .000
.002

        LAMBDA Y

             ETA 7       ETA 8       ETA 9      ETA 10      ETA 11       ETA
12
          ________    ________    ________    ________    ________
________
```

```
      AGE       .002      -.011      -.019      -.001       .001
 .008
 PRESTIGE      -.003       .013      -.208       .004      -.010
 .222
 EDUCATIO       .004      -.016       .287       .003       .029      -
 .303
 COMORBID      -.003       .008      -.691       .057      -.021
 .699
     MMSE       .003      -.014       .000       .000       .002      -
 .015
 PRESOCIA       .028       .008      -.475      -.003       .052
 .483
 PREHEALT       .000       .000      -.391      -.042       .015
 .391
 PRESCORE      -.004       .000      -.061      -.005      -.001
 .061
 POSTSOCI      -.009      -.548       .148       .000       .017      -
 .696
 POSTHEAL       .000       .000       .000       .000       .000
 .000
 POSTSCOR       .004       .000       .000       .000       .001
 .000

         BETA

                ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
 6
               --------   --------   --------   --------   --------
 --------
    ETA 1       .000       .000       .000       .000      -.003
 .002
    ETA 2       .000       .000       .000       .000      -.006
 .027
    ETA 3       .000       .000       .000       .000       .070      -
 .060
    ETA 4       .000       .000       .000       .000       .412
 .010
    ETA 5       .000       .003       .000       .015       .000
 .000
    ETA 6       .000       .454      -.032       .057       .000
 .000
    ETA 7       .000       .000       .000       .000       .000
 .000
    ETA 8       .000       .000       .000       .000       .000
 .000
    ETA 9       .000       .000      -.001       .000       .000      -
 .001
   ETA 10       .000       .115       .050       .276       .000
 .000
   ETA 11       .000       .000       .051       .000       .000
 .057
   ETA 12       .000       .017      -.001       .010       .000
 .002
```

```
        BETA

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
              --------   --------   --------   --------   --------
--------
   ETA 1        .000       .001      -.012       .000       .000
.013
   ETA 2       -.003       .013      -.212       .003      -.009
.226
   ETA 3        .007      -.029       .339       .008       .028       -
.368
   ETA 4       -.003       .008      -.725       .052      -.017
.733
   ETA 5        .004      -.015       .000       .000       .002       -
.015
   ETA 6        .028      -.088      -.430       .000       .054
.342
   ETA 7        .000       .000      -.391      -.042       .015
.391
   ETA 8        .000       .000      -.046      -.003       .000
.046
   ETA 9        .000       .000       .000       .000       .000
.000
  ETA 10       -.004      -.548       .148       .000       .019       -
.696
  ETA 11        .000       .000       .000       .000       .000
.000
  ETA 12        .004       .000       .000       .000       .001
.000

        PSI

                ETA 1      ETA 2      ETA 3      ETA 4      ETA 5       ETA
6
              --------   --------   --------   --------   --------
--------
   ETA 1        .000
   ETA 2        .000       .000
   ETA 3        .000       .000       .000
   ETA 4        .000       .000       .000       .000
   ETA 5        .000       .000       .001       .006       .000
   ETA 6        .003       .041      -.091       .013       .000
.000
   ETA 7        .000       .000       .000       .000       .000
.000
   ETA 8        .000       .000       .000       .000       .000
.000
   ETA 9        .000       .000      -.001       .000       .000       -
.001
  ETA 10       -.001      -.004       .046       .125      -.001
.000
  ETA 11        .000      -.008       .037       .005      -.001
.086
```

```
  ETA 12       .000       .001      -.002       .004       .000
.003

        PSI

               ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
            --------   --------   --------   --------   --------
--------
   ETA 7       .000
   ETA 8       .000       .000
   ETA 9       .000       .000       .000
  ETA 10      -.105      -.008       .000       .000
  ETA 11       .017      -.001       .000      -.025       .000
  ETA 12       .003       .000       .000      -.001       .000
.000

        THETA EPS

                 AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
            --------   --------   --------   --------   --------
--------
     AGE       .000
PRESTIGE       .001       .000
EDUCATIO      -.001       .001      -.001
COMORBID       .005       .001      -.009       .000
    MMSE       .000       .000       .002       .006       .000
PRESOCIA       .004       .044      -.097      -.020       .001
.001
PREHEALT      -.001       .003      -.010      -.002       .000      -
.004
PRESCORE       .000      -.001       .002      -.004       .000
.000
POSTSOCI      -.003      -.007       .043       .137      -.001
.006
POSTHEAL       .000      -.009       .040       .001      -.001
.093
POSTSCOR       .000       .001      -.001       .004       .000
.004

        THETA EPS

            PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
            --------   --------   --------   --------   --------
PREHEALT      -.004
PRESCORE      -.003       .000
POSTSOCI      -.099      -.012      -.004
POSTHEAL       .017       .000      -.025       .000
POSTSCOR       .003       .000      -.001       .000       .000

UNSPECIFIED TITLE
```

```
FACTOR SCORES REGRESSIONS

        ETA

                 AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
            --------   --------   --------   --------   --------

--------
   ETA 1        .994      -.001       .000       .001       .000      -
.001
   ETA 2       -.013       .837       .288       .026       .001
.007
   ETA 3        .000       .032       .835      -.013       .002      -
.004
   ETA 4        .001       .003      -.012       .877       .000
.010
   ETA 5       -.028       .004       .145       .020       .791
.066
   ETA 6        .000       .000       .000       .000       .000
.995
   ETA 7        .000       .000      -.001       .001       .000      -
.001
   ETA 8        .001      -.006      -.025      -.056      -.001
.032
   ETA 9        .048       .002      -.020      -.075      -.004
.027
  ETA 10        .000       .000       .000       .000       .000
.001
  ETA 11        .000       .000       .000       .001       .000
.000
  ETA 12       -.046      -.008      -.006       .018       .003
.005

        ETA

            PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
            --------   --------   --------   --------   --------
   ETA 1       -.004       .000      -.010       .000       .000
   ETA 2        .062      -.004      -.015      -.081      -.001
   ETA 3       -.038      -.002      -.001      -.004       .000
   ETA 4        .058      -.004       .006       .030       .000
   ETA 5       -.030      -.004      -.006      -.126       .002
   ETA 6        .000       .000       .001       .000       .000
   ETA 7        .993       .000       .000       .002       .000
   ETA 8       -.157       .868      -.040      -.082       .019
   ETA 9       -.218       .758      -.136       .262      -.854
  ETA 10        .000       .000       .994      -.001       .000
  ETA 11        .002       .000      -.001       .993       .000
  ETA 12        .060       .110       .095      -.343       .872

UNSPECIFIED TITLE


STANDARDIZED SOLUTION
```

```
       LAMBDA Y

             ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
          ________  ________  ________  ________  ________

________
     AGE     6.995       .000       .000       .000       .000
.000
PRESTIGE      .000      4.773       .000       .000       .000
.000
EDUCATIO      .000       .000      1.593       .000       .000
.000
COMORBID      .000       .000       .000      1.528       .000
.000
    MMSE      .000       .000       .000       .000      8.183
.000
PRESOCIA      .000       .000       .000       .000       .000
.816
PREHEALT      .000       .000       .000       .000       .000
.000
PRESCORE      .000       .000       .000       .000       .000
.000
POSTSOCI      .000       .000       .000       .000       .000
.000
POSTHEAL      .000       .000       .000       .000       .000
.000
POSTSCOR      .000       .000       .000       .000       .000
.000

       LAMBDA Y

             ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
          ________  ________  ________  ________  ________

________
     AGE      .000       .000       .000       .000       .000
.000
PRESTIGE      .000       .000       .000       .000       .000
.000
EDUCATIO      .000       .000       .000       .000       .000
.000
COMORBID      .000       .000       .000       .000       .000
.000
    MMSE      .000       .000       .000       .000       .000
.000
PRESOCIA      .000       .000       .000       .000       .000
.000
PREHEALT      .990       .000       .000       .000       .000
.000
PRESCORE      .000      6.002       .000       .000       .000
.000
POSTSOCI      .000       .000       .000       .660       .000
.000
```

```
POSTHEAL       .000        .000        .000        .000        .933
.000
POSTSCOR       .000        .000        .000        .000        .000
14.582

        BETA

              ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
            --------    --------    --------    --------    --------
--------
   ETA 1       .000        .000        .000        .000        .000
.000
   ETA 2       .000        .000        .000        .000        .000
.000
   ETA 3       .000        .000        .000        .000        .000
.000
   ETA 4       .000        .000        .000        .000        .000
.000
   ETA 5      -.124        .000        .170        .000        .000
.000
   ETA 6      -.068        .000        .000        .000        .039
.000
   ETA 7      -.079        .090       -.204        .321       -.026        -
.089
   ETA 8      -.047       -.055       -.018       -.261        .010
.067
   ETA 9       .000        .000        .000        .000        .000
.000
  ETA 10      -.182        .000        .000        .000        .008
.217
  ETA 11      -.003       -.131        .000        .142       -.054
.000
  ETA 12      -.177        .000        .000        .000        .027
.000

        BETA

              ETA 7       ETA 8       ETA 9      ETA 10      ETA 11       ETA
12
            --------    --------    --------    --------    --------
--------
   ETA 1       .000        .000        .000        .000        .000
.000
   ETA 2       .000        .000        .000        .000        .000
.000
   ETA 3       .000        .000        .000        .000        .000
.000
   ETA 4       .000        .000        .000        .000        .000
.000
   ETA 5       .000        .000        .000        .000        .000
.000
   ETA 6       .000        .000        .000        .000        .000
.000
```

```
   ETA 7       .000       -.224        .000        .000        .000
.000
   ETA 8       .000        .000        .000        .000        .000
.000
   ETA 9       .000        .458        .000        .000        .000       -
1.113
  ETA 10       .000        .000        .000        .000        .000
.000
  ETA 11       .253        .000       -.193       -.133        .000       -
.381
  ETA 12       .000        .428        .000        .058        .000
.000

        CORRELATION MATRIX OF ETA

              ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
            --------    --------    --------    --------    --------
--------
   ETA 1      1.000
   ETA 2      -.191       1.000
   ETA 3      -.110        .664       1.000
   ETA 4       .046       -.027       -.153       1.000
   ETA 5      -.143        .137        .184       -.032       1.000
   ETA 6      -.074        .018        .015       -.004        .049
1.000
   ETA 7      -.037       -.033       -.189        .405       -.058       -
.102
   ETA 8      -.052       -.049       -.007       -.260        .017
.071
   ETA 9       .215       -.043       -.029        .015       -.061       -
.032
  ETA 10      -.199        .040        .025       -.010        .045
.231
  ETA 11       .094       -.154       -.173        .294       -.109       -
.078
  ETA 12      -.215        .019        .023       -.121        .062
.058

        CORRELATION MATRIX OF ETA

              ETA 7       ETA 8       ETA 9      ETA 10      ETA 11      ETA
12
            --------    --------    --------    --------    --------
--------
   ETA 7      1.000
   ETA 8      -.312       1.000
   ETA 9       .001       -.031       1.000
  ETA 10      -.016        .025       -.106       1.000
  ETA 11       .370       -.275        .179       -.166       1.000
  ETA 12      -.130        .439       -.911        .106       -.274
1.000

        PSI
```

```
                 ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
              --------   --------   --------   --------   --------
--------
    ETA 1      1.000
    ETA 2      -.191      1.000
    ETA 3      -.110       .664      1.000
    ETA 4       .046      -.027      -.153      1.000
    ETA 5       .000       .000       .000       .000       .951
    ETA 6       .000       .000       .000       .000       .000
.993
    ETA 7       .000       .000       .000       .000       .000
.000
    ETA 8       .000       .000       .000       .000       .000
.000
    ETA 9       .000       .000       .000       .000       .000
.000
   ETA 10       .000       .000       .000       .000       .000
.000
   ETA 11       .000       .000       .000       .000       .000
.000
   ETA 12       .000       .000       .000       .000       .000
.000

        PSI

                 ETA 7      ETA 8      ETA 9     ETA 10     ETA 11     ETA
12
              --------   --------   --------   --------   --------
--------
    ETA 7       .751
    ETA 8       .000       .922
    ETA 9       .000       .000       .000
   ETA 10       .000       .000       .000       .913
   ETA 11       .000       .000       .000       .000       .747
   ETA 12       .000       .000       .000       .000       .000
.766

UNSPECIFIED TITLE


MODIFICATION INDICES AND ESTIMATED CHANGE

        MODIFICATION INDICES FOR LAMBDA Y

                 ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
              --------   --------   --------   --------   --------
--------
      AGE       .000      1.009       .011      7.159       .097
1.795
PRESTIGE        .000       .000       .387       .000       .002
4.290
```

```
EDUCATIO        .000       .012       .000      1.881       .086
2.128
COMORBID        .000       .000       .387       .000      1.884
.022
    MMSE        .000       .000       .309      1.663       .000
.222
PRESOCIA        .000      1.352       .107       .005       .000
.000
PREHEALT        .000       .000       .387       .000       .000
.770
PRESCORE        .000       .628       .029      2.068       .000
.065
POSTSOCI        .000       .039       .145      2.910       .000
.407
POSTHEAL        .000       .000       .387       .000       .000
.770
POSTSCOR        .000       .628       .000      2.068       .000
.369

        MODIFICATION INDICES FOR LAMBDA Y

               ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
            --------   --------   --------   --------   --------
--------
     AGE        .647      1.163       .702       .191      1.434
.090
PRESTIGE       3.589      3.770      1.079       .109      1.026
1.218
EDUCATIO        .507       .478       .222       .006       .454
.247
COMORBID        .354       .219      1.617      3.782      4.419
1.651
    MMSE       1.447      1.610       .000       .133       .795
.514
PRESOCIA        .556       .002       .224       .227       .499
.224
PREHEALT        .000       .000       .184       .739       .711
.184
PRESCORE        .877       .000      1.452       .414       .264
1.452
POSTSOCI        .008       .825       .286       .000       .131
1.024
POSTHEAL        .000       .000       .000       .000       .000
.000
POSTSCOR        .877       .000       .000       .000       .849
.000

        ESTIMATED CHANGE FOR LAMBDA Y

               ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
            --------   --------   --------   --------   --------
--------
```

```
     AGE        .000        -.374        -.122       -2.967         .140        -
3.072
PRESTIGE        .000         .000       -1.331         .000         .002        -
.679
EDUCATIO        .000         .024         .000         .662        -.006
.160
COMORBID        .000         .000         .393         .000        -.021        -
.020
    MMSE        .000         .001       -3.200        -.545         .000        -
1.784
PRESOCIA        .000        -.014         .012        -.003         .000
.000
PREHEALT        .000         .000         .143         .000         .000
.256
PRESCORE        .000         .161        -.102         .926         .000
.281
POSTSOCI        .000        -.002        -.011        -.050         .000        -
.217
POSTHEAL        .000         .000        -.034         .000         .000        -
.061
POSTSCOR        .000        -.167         .002        -.963         .000        -
.706

        ESTIMATED CHANGE FOR LAMBDA Y

              ETA 7        ETA 8        ETA 9       ETA 10       ETA 11       ETA
12
            --------     --------     --------     --------     --------
--------
     AGE      -1.454         .462         .167        1.580       -4.666        -
.054
PRESTIGE       4.796       -1.285         .023        -.136         .482        -
.025
EDUCATIO       -.558         .138        -.004        -.011        -.072
.004
COMORBID        .602        -.124         .011        -.298         .957        -
.011
    MMSE      -1.973         .506        -.005        1.837       -2.019
.158
PRESOCIA       -.089        -.001         .002         .344        -.043        -
.002
PREHEALT        .000         .000         .002         .080        -.216        -
.002
PRESCORE        .903         .000         .108         .410         .901        -
.108
POSTSOCI        .004         .007        -.009         .000        -.035
.007
POSTHEAL        .000         .000         .000         .000         .000
.000
POSTSCOR       -.939         .000         .000         .000       -2.706
.000

        MODIFICATION INDICES FOR BETA
```

```
                ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
              --------   --------   --------   --------   --------

--------
   ETA 1        .000       .000       .000       .000       .097
1.727
   ETA 2        .000       .000       .000       .000       .002
3.901
   ETA 3        .000       .000       .000       .000       .086
2.186
   ETA 4        .000       .000       .000       .000      1.884
.087
   ETA 5        .000       .012       .000      1.881       .000
.069
   ETA 6        .000      1.556       .069       .230       .000
.000
   ETA 7        .000       .000       .000       .000       .000
.000
   ETA 8        .000       .000       .000       .000       .000
.000
   ETA 9        .000       .000       .387       .000       .000
.770
  ETA 10        .000       .060       .100      3.205       .000
.000
  ETA 11        .000       .000       .387       .000       .000
.770
  ETA 12        .000       .628       .006      2.068       .000
.210

        MODIFICATION INDICES FOR BETA

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
              --------   --------   --------   --------   --------

--------
   ETA 1       1.510      1.617       .309       .004       .636
.358
   ETA 2       3.589      3.770      1.129       .077       .994
1.272
   ETA 3       1.982      2.083       .330       .061       .494
.387
   ETA 4        .354       .219      2.276      3.609      3.050
2.319
   ETA 5       1.743      1.775       .001       .063      1.034
.542
   ETA 6        .689       .499       .207       .000       .600
.128
   ETA 7        .000       .000       .184       .739       .711
.184
   ETA 8        .000       .000      1.597       .193       .064
1.597
   ETA 9        .000       .000       .000       .000       .000
.000
```

```
   ETA 10       .001        .825        .286        .000        .161
1.024
   ETA 11       .000        .000        .000        .000        .000
.000
   ETA 12       .877        .000        .000        .000        .849
.000

        ESTIMATED CHANGE FOR BETA

               ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
            --------    --------    --------    --------    --------
--------
    ETA 1       .000        .000        .000        .000        .140     -
4.054
    ETA 2       .000        .000        .000        .000        .002      -
.650
    ETA 3       .000        .000        .000        .000       -.006
.165
    ETA 4       .000        .000        .000        .000       -.021      -
.039
    ETA 5       .000       -.021        .000       -.580        .000     -
1.074
    ETA 6       .000       -.016        .010       -.018        .000
.000
    ETA 7       .000        .000        .000        .000        .000
.000
    ETA 8       .000        .000        .000        .000        .000
.000
    ETA 9       .000        .000       2.477        .000        .000
4.446
   ETA 10       .000       -.002       -.009       -.053        .000
.000
   ETA 11       .000        .000       -.034        .000        .000      -
.061
   ETA 12       .000       -.167        .050       -.963        .000      -
.540

        ESTIMATED CHANGE FOR BETA

               ETA 7       ETA 8       ETA 9      ETA 10      ETA 11      ETA
12
            --------    --------    --------    --------    --------
--------
    ETA 1     29.545      -7.924        .118       -.245       8.850      -
.127
    ETA 2      4.796      -1.285        .024       -.115        .482      -
.025
    ETA 3     -1.230        .326       -.004       -.035       -.079
.005
    ETA 4       .602       -.124        .014       -.314        .793      -
.014
    ETA 5     -2.176        .532        .007       1.288      -2.314
.167
```

```
     ETA 6      -.112       .026       .002       .000      -.051        -
 .002
     ETA 7       .000       .000       .002       .080      -.216        -
 .002
     ETA 8       .000       .000       .156       .288       .720        -
 .156
     ETA 9       .000       .000       .000       .000       .000
 .000
    ETA 10       .002       .007      -.009       .000      -.039
 .007
    ETA 11       .000       .000       .000       .000       .000
 .000
    ETA 12      -.939       .000       .000       .000     -2.706
 .000

         MODIFICATION INDICES FOR PSI

                ETA 1      ETA 2      ETA 3      ETA 4      ETA 5       ETA
 6
              --------   --------   --------   --------   --------
 --------
     ETA 1       .000
     ETA 2       .000       .000
     ETA 3       .000       .000       .000
     ETA 4       .000       .000       .000       .000
     ETA 5       .097       .002       .086      1.884       .000
     ETA 6      1.751      3.914      2.208       .062       .069
 .000
     ETA 7       .000       .000       .000       .000       .000
 .000
     ETA 8       .000       .000       .000       .000       .000
 .000
     ETA 9       .000       .387       .387       .387       .000
 .770
    ETA 10       .053       .026       .342      3.502       .100
 .000
    ETA 11       .387       .387       .387       .387       .387
 .770
    ETA 12       .312      1.092       .356      1.776       .000
 .210

         MODIFICATION INDICES FOR PSI

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
 12
              --------   --------   --------   --------   --------
 --------
     ETA 7       .000
     ETA 8       .000       .000
     ETA 9      1.026       .000       .000
    ETA 10       .739       .193       .770       .000
    ETA 11      1.026       .570       .000       .770       .000
    ETA 12       .239      1.998       .000       .210       .000
 .000
```

```
         ESTIMATED CHANGE FOR PSI

               ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
            --------   --------   --------   --------   --------
 --------
    ETA 1      .000
    ETA 2      .000       .000
    ETA 3      .000       .000       .000
    ETA 4      .000       .000       .000       .000
    ETA 5     8.915       .116      -.351     -1.318       .000
    ETA 6    -2.704      -.431       .110      -.022      -.711
.000
    ETA 7      .000       .000       .000       .000       .000
.000
    ETA 8      .000       .000       .000       .000       .000
.000
    ETA 9      .000    -15.282      3.393     23.950       .000
2.943
   ETA 10      .366       .027      -.034      -.127       .664
.000
   ETA 11     8.969       .210      -.047      -.330      2.478        -
.040
   ETA 12   -19.329     -3.865       .746     -2.052       .000        -
.357

         ESTIMATED CHANGE FOR PSI

               ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
            --------   --------   --------   --------   --------
 --------
    ETA 7      .000
    ETA 8      .000       .000
    ETA 9    19.688       .000       .000
   ETA 10      .032       .115    -10.100       .000
   ETA 11     -.271      3.497       .000       .139       .000
   ETA 12     -.397    -29.250       .000      1.226       .000
.000

         MODIFICATION INDICES FOR THETA EPS

                 AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
            --------   --------   --------   --------   --------
 --------
      AGE      .095
 PRESTIGE     1.003       .406
 EDUCATIO      .079       .235       .086
 COMORBID     6.131       .342      1.793       .023
     MMSE      .204       .042       .218      1.751       .000
 PRESOCIA     1.966      4.221      2.311       .131       .318
.227
```

```
PREHEALT       .076       .481       .407       .437       .358
.013
PRESCORE       .260      1.214       .370      1.200       .072
.001
POSTSOCI       .715       .063       .272      3.533       .318
.054
POSTHEAL       .060       .406       .407       .023       .726
.786
POSTSCOR       .822       .878       .132      1.221       .000
.395

         MODIFICATION INDICES FOR THETA EPS

            PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
            --------   --------   --------   --------   --------
PREHEALT      1.026
PRESCORE       .197      1.817
POSTSOCI       .655       .416       .407
POSTHEAL      1.026       .013       .770       .000
POSTSCOR       .272      1.797       .369       .000       .000

         ESTIMATED CHANGE FOR THETA EPS

                 AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
            --------   --------   --------   --------   --------
--------
     AGE     -17.616
PRESTIGE      -6.268      8.264
EDUCATIO        .594      -.957       .401
COMORBID      -5.802     -1.985       .886      1.212
    MMSE      12.131       .494      -.556     -1.269       .000
PRESOCIA      -2.031      -.435       .108       .030     -1.370     -
.781
PREHEALT        .426      -.865       .192      1.147     -5.838
.016
PRESCORE       6.756      3.867      -.691      1.434     10.924     -
.020
POSTSOCI       1.212       .042      -.029      -.117      1.143     -
.040
POSTHEAL      -2.311       .212      -.046      -.105      3.397     -
.038
POSTSCOR     -29.502     -3.436       .436     -1.503       .000     -
.456

         ESTIMATED CHANGE FOR THETA EPS

            PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
            --------   --------   --------   --------   --------
PREHEALT      1.135
PRESCORE       .346     19.240
POSTSOCI       .030       .163       .494
POSTHEAL      -.271       .554       .139       .000
POSTSCOR      -.423    -19.900      1.605       .000       .000
```

```
       MAXIMUM MODIFICATION INDEX IS    7.16 FOR ELEMENT ( 1, 4) OF
LAMBDA Y


         THE PROBLEM USED    33072 BYTES (=  6.3% OF AVAILABLE
WORKSPACE)


                          TIME USED :     1.3 SECONDS
```

APPENDIX 14

LISREL COMPUTER OUTPUT- PROXY MODEL

```
                              L I S R E L  7.20

                                     BY

                        KARL G JORESKOG AND DAG SORBOM

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THE FOLLOWING LISREL CONTROL LINES HAVE BEEN READ :


DA NI=11 NO=145 MA=CM XM=-0.989898D+09
CM FI=c:\windows\temp\spssbl1.tmp FO
(5E14.6)
LA
AGE   PRESTIGE   EDUCATION   COMORBID   MMSE   PRESOCIAL   PREHEALTH
   PRESCORE   POSTSOCIAL   POSTHEALTH   POSTSCORE
MO NY=11 NE=12 LY=FU,FI BE=FU,FI PS=SY,FI TE=SY,FI
 FR BE(5,1) BE(5,3)
 FR BE(6,5)
 FR BE(7,1) BE(7,2) BE(7,3) BE(7,4)BE(7,5) BE(7,6) BE(7,8)
 FR BE(8,1) BE(8,2) BE(8,3) BE(8,4) BE(8,5) BE(8,6)
 FR BE(10,5) BE(10,6)
 FR BE(11,2) BE(11,4) BE(11,5) BE(11,7) BE(11,9) BE(11,10)  BE(11,12)
 FR BE(12,5) BE(12,8) BE(12,10)
 VA 1.0 BE(9,8)
 VA -1.0 BE(9,12)
 FR PS(1,1)
 FR PS(2,1) PS(2,2)
 FR PS(3,1) PS(3,2) PS(3,3)
 FR PS(4,1) PS(4,2) PS(4,3) PS(4,4)
 FR PS(5,5) PS(6,6)PS(7,7) PS(8,8) PS(10,10) PS(11,11) PS(12,12)
 ST 47 PS(1,1)
 ST -.3 PS(2,1)
 ST 18 PS(2,2)
 ST -.5 PS(3,1)
 ST 1.8 PS(3,2)
 ST 2 PS(3,3) PS(4,4)
 ST -.02 PS(4,1)
 ST 2 PS(4,2)
 ST .06 PS(4,3)
 ST 600 PS(5,5)
 ST .5 PS(6,6)
 ST 1 PS(7,7)
 ST 500 PS(8,8)
 ST .6 PS(10,10)
 ST 1 PS(11,11)
 ST 900 PS(12,12)
 VA 1.0 LY(1,1) LY(2,2) LY(3,3) LY(4,4) LY(5,5) LY(6,6) LY(7,7)
VA 1.0 LY(8,8) LY(9,10) LY(10,11) LY(11,12)
 VA 0.458957 TE(1,1)
 VA 5.33364 TE(2,2)
 VA 0.3844166 TE(3,3)
 VA 0.521992 TE(4,4)
 VA 138.8396 TE(5,5)
 VA .00638422 TE(6,6)
 VA  .2182 TE(7,7)
 VA 74.1609 TE(8,8)
 VA 0.00774148 TE(9,9)
 VA 0.207986 TE(10,10)
 VA 141.1344 TE (11,11)
OU ML AL NS AD=200

UNSPECIFIED TITLE

                          NUMBER OF INPUT VARIABLES 11

                          NUMBER OF Y - VARIABLES   11

                          NUMBER OF X - VARIABLES    0

                          NUMBER OF ETA - VARIABLES 12

                          NUMBER OF KSI - VARIABLES  0

                          NUMBER OF OBSERVATIONS   145

UNSPECIFIED TITLE

        COVARIANCE MATRIX TO BE ANALYZED

                AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
           --------   --------   --------   --------   --------

--------
     AGE     45.896
PRESTIGE     -1.059     26.668
EDUCATIO       .003      1.830      1.921
COMORBID      -.350      2.632      -.030      2.610
    MMSE     18.693       .428      3.915     -3.122    694.198
PRESOCIA      -.386       .326      -.005      -.040       .185
.638
PREHEALT     -1.103      -.308      -.045       .370     -1.507      -
.188
PRESCORE    -17.585       .848      3.655     -3.706    148.210
1.644
```

```
POSTSOCI      -.107        .279       -.027       -.092       1.954
.421
POSTHEAL      -.192       -.382        .162        .218      -2.912         -
.015
POSTSCOR     -6.059      10.097        .253      -3.600     392.860
2.094

        COVARIANCE MATRIX TO BE ANALYZED

            PREHEALT    PRESCORE    POSTSOCI    POSTHEAL    POSTSCOR
            --------    --------    --------    --------    --------
PREHEALT      1.091
PRESCORE     -7.331     494.406
POSTSOCI      -.254       2.977        .774
POSTHEAL       .237      -2.391       -.174       1.040
POSTSCOR     -5.373     333.596       5.652     -11.496     940.896

UNSPECIFIED TITLE

PARAMETER SPECIFICATIONS

        LAMBDA Y

               ETA 1       ETA 2       ETA 3       ETA 4       ETA 5        ETA
6
            --------    --------    --------    --------    --------
--------
     AGE          0           0           0           0           0
0
PRESTIGE          0           0           0           0           0
0
EDUCATIO          0           0           0           0           0
0
COMORBID          0           0           0           0           0
0
    MMSE          0           0           0           0           0
0
PRESOCIA          0           0           0           0           0
0
PREHEALT          0           0           0           0           0
0
PRESCORE          0           0           0           0           0
0
POSTSOCI          0           0           0           0           0
0
POSTHEAL          0           0           0           0           0
0
POSTSCOR          0           0           0           0           0
0

        LAMBDA Y

               ETA 7       ETA 8       ETA 9      ETA 10      ETA 11        ETA
12
```

```
                 ________  ________  ________  ________  ________

        ________
             AGE        0         0         0         0         0
        0
        PRESTIGE        0         0         0         0         0
        0
        EDUCATIO        0         0         0         0         0
        0
        COMORBID        0         0         0         0         0
        0
            MMSE        0         0         0         0         0
        0
        PRESOCIA        0         0         0         0         0
        0
        PREHEALT        0         0         0         0         0
        0
        PRESCORE        0         0         0         0         0
        0
        POSTSOCI        0         0         0         0         0
        0
        POSTHEAL        0         0         0         0         0
        0
        POSTSCOR        0         0         0         0         0
        0

                BETA

                    ETA 1     ETA 2     ETA 3     ETA 4     ETA 5     ETA
        6
                 ________  ________  ________  ________  ________

        ________
           ETA 1        0         0         0         0         0
        0
           ETA 2        0         0         0         0         0
        0
           ETA 3        0         0         0         0         0
        0
           ETA 4        0         0         0         0         0
        0
           ETA 5        1         0         2         0         0
        0
           ETA 6        0         0         0         0         3
        0
           ETA 7        4         5         6         7         8
        9
           ETA 8       11        12        13        14        15
        16
           ETA 9        0         0         0         0         0
        0
          ETA 10        0         0         0         0        17
        18
          ETA 11        0        19         0        20        21
        0
```

```
   ETA 12          0          0          0          0         26
0

         BETA

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
              --------   --------   --------   --------   --------
--------
    ETA 1          0          0          0          0          0
0
    ETA 2          0          0          0          0          0
0
    ETA 3          0          0          0          0          0
0
    ETA 4          0          0          0          0          0
0
    ETA 5          0          0          0          0          0
0
    ETA 6          0          0          0          0          0
0
    ETA 7          0         10          0          0          0
0
    ETA 8          0          0          0          0          0
0
    ETA 9          0          0          0          0          0
0
   ETA 10          0          0          0          0          0
0
   ETA 11         22          0         23         24          0
25
   ETA 12          0         27          0         28          0
0

         PSI

                ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
              --------   --------   --------   --------   --------
--------
    ETA 1         29
    ETA 2         30         31
    ETA 3         32         33         34
    ETA 4         35         36         37         38
    ETA 5          0          0          0          0         39
    ETA 6          0          0          0          0          0
40
    ETA 7          0          0          0          0          0
0
    ETA 8          0          0          0          0          0
0
    ETA 9          0          0          0          0          0
0
```

```
  ETA 10         0          0          0          0          0
0
  ETA 11         0          0          0          0          0
0
  ETA 12         0          0          0          0          0
0

         PSI

                 ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
             --------   --------   --------   --------   --------
--------
   ETA 7        41
   ETA 8         0         42
   ETA 9         0          0          0
  ETA 10         0          0          0         43
  ETA 11         0          0          0          0         44
  ETA 12         0          0          0          0          0
45

         THETA EPS

                   AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
             --------   --------   --------   --------   --------
--------
     AGE         0
PRESTIGE         0          0
EDUCATIO         0          0          0
COMORBID         0          0          0          0
    MMSE         0          0          0          0          0
PRESOCIA         0          0          0          0          0
0
PREHEALT         0          0          0          0          0
0
PRESCORE         0          0          0          0          0
0
POSTSOCI         0          0          0          0          0
0
POSTHEAL         0          0          0          0          0
0
POSTSCOR         0          0          0          0          0
0

         THETA EPS

              PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
              --------   --------   --------   --------   --------
PREHEALT         0
PRESCORE         0          0
POSTSOCI         0          0          0
POSTHEAL         0          0          0          0
POSTSCOR         0          0          0          0          0
```

```
UNSPECIFIED TITLE

STARTING VALUES

        LAMBDA Y

               ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
             --------   --------   --------   --------   --------
--------
     AGE       1.000       .000       .000       .000       .000
.000
PRESTIGE        .000      1.000       .000       .000       .000
.000
EDUCATIO        .000       .000      1.000       .000       .000
.000
COMORBID        .000       .000       .000      1.000       .000
.000
    MMSE        .000       .000       .000       .000      1.000
.000
PRESOCIA        .000       .000       .000       .000       .000
1.000
PREHEALT        .000       .000       .000       .000       .000
.000
PRESCORE        .000       .000       .000       .000       .000
.000
POSTSOCI        .000       .000       .000       .000       .000
.000
POSTHEAL        .000       .000       .000       .000       .000
.000
POSTSCOR        .000       .000       .000       .000       .000
.000

        LAMBDA Y

               ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
             --------   --------   --------   --------   --------
--------
     AGE        .000       .000       .000       .000       .000
.000
PRESTIGE        .000       .000       .000       .000       .000
.000
EDUCATIO        .000       .000       .000       .000       .000
.000
COMORBID        .000       .000       .000       .000       .000
.000
    MMSE        .000       .000       .000       .000       .000
.000
PRESOCIA        .000       .000       .000       .000       .000
.000
PREHEALT       1.000       .000       .000       .000       .000
.000
```

```
PRESCORE       .000      1.000       .000       .000       .000
.000
POSTSOCI       .000       .000       .000      1.000       .000
.000
POSTHEAL       .000       .000       .000       .000      1.000
.000
POSTSCOR       .000       .000       .000       .000       .000
1.000

        BETA

              ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
           --------   --------   --------   --------   --------
--------
   ETA 1       .000       .000       .000       .000       .000
.000
   ETA 2       .000       .000       .000       .000       .000
.000
   ETA 3       .000       .000       .000       .000       .000
.000
   ETA 4       .000       .000       .000       .000       .000
.000
   ETA 5       .000       .000       .000       .000       .000
.000
   ETA 6       .000       .000       .000       .000       .000
.000
   ETA 7       .000       .000       .000       .000       .000
.000
   ETA 8       .000       .000       .000       .000       .000
.000
   ETA 9       .000       .000       .000       .000       .000
.000
  ETA 10       .000       .000       .000       .000       .000
.000
  ETA 11       .000       .000       .000       .000       .000
.000
  ETA 12       .000       .000       .000       .000       .000
.000

        BETA

              ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
           --------   --------   --------   --------   --------
--------
   ETA 1       .000       .000       .000       .000       .000
.000
   ETA 2       .000       .000       .000       .000       .000
.000
   ETA 3       .000       .000       .000       .000       .000
.000
   ETA 4       .000       .000       .000       .000       .000
.000
```

```
   ETA 5       .000        .000        .000        .000        .000
.000
   ETA 6       .000        .000        .000        .000        .000
.000
   ETA 7       .000        .000        .000        .000        .000
.000
   ETA 8       .000        .000        .000        .000        .000
.000
   ETA 9       .000       1.000        .000        .000        .000      -
1.000
  ETA 10       .000        .000        .000        .000        .000
.000
  ETA 11       .000        .000        .000        .000        .000
.000
  ETA 12       .000        .000        .000        .000        .000
.000

        COVARIANCE MATRIX OF ETA

              ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
            ________    ________    ________    ________    ________
________
   ETA 1     47.000
   ETA 2      -.300      18.000
   ETA 3      -.500       1.800       2.000
   ETA 4      -.020       2.000        .060       2.000
   ETA 5       .000        .000        .000        .000     600.000
   ETA 6       .000        .000        .000        .000        .000
.500
   ETA 7       .000        .000        .000        .000        .000
.000
   ETA 8       .000        .000        .000        .000        .000
.000
   ETA 9       .000        .000        .000        .000        .000
.000
  ETA 10       .000        .000        .000        .000        .000
.000
  ETA 11       .000        .000        .000        .000        .000
.000
  ETA 12       .000        .000        .000        .000        .000
.000

        COVARIANCE MATRIX OF ETA

              ETA 7       ETA 8       ETA 9      ETA 10      ETA 11       ETA
12
            ________    ________    ________    ________    ________
________
   ETA 7      1.000
   ETA 8       .000     500.000
   ETA 9       .000     500.000    1400.000
  ETA 10       .000        .000        .000        .600
  ETA 11       .000        .000        .000        .000       1.000
  ETA 12        .000        .000    -900.000        .000        .000
900.000

        PSI

               ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
            --------   --------   --------   --------   --------
--------
    ETA 1     47.000
    ETA 2      -.300     18.000
    ETA 3      -.500      1.800      2.000
    ETA 4      -.020      2.000       .060      2.000
    ETA 5       .000       .000       .000       .000    600.000
    ETA 6       .000       .000       .000       .000       .000
.500
    ETA 7       .000       .000       .000       .000       .000
.000
    ETA 8       .000       .000       .000       .000       .000
.000
    ETA 9       .000       .000       .000       .000       .000
.000
   ETA 10       .000       .000       .000       .000       .000
.000
   ETA 11       .000       .000       .000       .000       .000
.000
   ETA 12       .000       .000       .000       .000       .000
.000

        PSI

               ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
            --------   --------   --------   --------   --------
--------
    ETA 7      1.000
    ETA 8       .000    500.000
    ETA 9       .000       .000       .000
   ETA 10       .000       .000       .000       .600
   ETA 11       .000       .000       .000       .000      1.000
   ETA 12       .000       .000       .000       .000       .000
900.000

        THETA EPS

                 AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
            --------   --------   --------   --------   --------
--------
     AGE        .459
PRESTIGE        .000      5.334
EDUCATIO        .000       .000       .384
COMORBID        .000       .000       .000       .522
    MMSE        .000       .000       .000       .000    138.840
```

```
PRESOCIA       .000       .000       .000       .000       .000
.006
PREHEALT       .000       .000       .000       .000       .000
.000
PRESCORE       .000       .000       .000       .000       .000
.000
POSTSOCI       .000       .000       .000       .000       .000
.000
POSTHEAL       .000       .000       .000       .000       .000
.000
POSTSCOR       .000       .000       .000       .000       .000
.000

        THETA EPS

           PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
           --------   --------   --------   --------   --------
PREHEALT       .218
PRESCORE       .000     74.161
POSTSOCI       .000       .000       .008
POSTHEAL       .000       .000       .000       .208
POSTSCOR       .000       .000       .000       .000    141.134

        SQUARED MULTIPLE CORRELATIONS FOR Y - VARIABLES

                AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
           --------   --------   --------   --------   --------
--------
               .990       .771       .839       .793       .812
.987

        SQUARED MULTIPLE CORRELATIONS FOR Y - VARIABLES

           PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
           --------   --------   --------   --------   --------
               .821       .871       .987       .828       .864

        TOTAL COEFFICIENT OF DETERMINATION FOR Y - VARIABLES IS  1.000

        SQUARED MULTIPLE CORRELATIONS FOR STRUCTURAL EQUATIONS

              ETA 1      ETA 2      ETA 3      ETA 4      ETA 5        ETA
6
           --------   --------   --------   --------   --------
--------
               .000       .000       .000       .000       .000
.000

        SQUARED MULTIPLE CORRELATIONS FOR STRUCTURAL EQUATIONS

              ETA 7      ETA 8      ETA 9     ETA 10     ETA 11        ETA
12
```

```
                _________  _________  _________  _________  _________
_________
                     .000       .000      1.000       .000       .000
.000

           BEHAVIOR UNDER STEEPEST DESCENT ITERATIONS


           ITER  TRY    ABSCISSA           SLOPE               FUNCTION

              1    0     .00000000D+00    -.15096862D+03
.91395819D+00
                   1     .10000000D+01     .31215302D+01
.19362186D+02
                   2     .75000000D+00     .41490062D+01
.18465834D+02
                   3     .56250000D+00     .55345811D+01
.17570721D+02
                   4     .42187500D+00     .74149465D+01
.16673317D+02
                   5     .31640625D+00     .99895217D+01
.15769200D+02
                   6     .23730469D+00     .13559650D+02
.14852404D+02
                   7     .17797852D+00     .18597659D+02
.13914451D+02
                   8     .15845822D+00     .21207215D+02
.13527076D+02
                   9     .13894063D+00     .24677932D+02
.13081012D+02
                  10     .11941979D+00     .29510288D+02
.12554910D+02
                  11     .99893344D-01     .36656538D+02
.11913839D+02
                  12     .80377069D-01     .48098703D+02
.11096353D+02
                  13     .60956339D-01     .68322902D+02
.99863017D+01
                  14     .41964661D-01     .10729037D+03
.83623234D+01
                  15     .24530983D-01     .17523516D+03
.59511757D+01
                  16     .11353053D-01     .24594703D+03
.31993130D+01
                  17     .43181837D-02     .25536788D+03
.13247578D+01
                  18     .16043605D-02     .58354271D+02
.84225789D+00
                  19     .11571028D-02     .28477441D+01
.82839741D+00

              2    0     .00000000D+00    -.20304920D+02
.82839741D+00
```

```
                  1     .11571028D-02    -.82477198D+01
.81185191D+00
                  2     .19486181D-02     .12028585D+00
.80863125D+00

             3    0     .00000000D+00    -.10768028D+02
.80863125D+00
                  1     .19486181D-02     .42192406D+01
.80237574D+00
                  2     .14000399D-02     .83435511D-01
.80119182D+00

          BEHAVIOR UNDER MINIMIZATION ITERATIONS

          ITER  TRY    ABSCISSA          SLOPE             FUNCTION

             1    0     .00000000D+00    -.14505121D+01
.80119182D+00
                  1     .10000000D+01     .28377162D+00
.22193271D+00
                  2     .83637532D+00     .16386438D-02
.19859350D+00

             2    0     .00000000D+00    -.18619314D+00
.19859350D+00
                  1     .83637532D+00    -.32619458D-01     .94529159D-
01
                  2     .10140237D+01     .35849637D-01     .94481128D-
01
                  3     .92100901D+00    -.28087892D-02     .92997881D-
01

             3    0     .00000000D+00    -.55233007D-01     .92997881D-
01
                  1     .92100901D+00     .41309327D-01     .80976623D-
01
                  2     .52692011D+00    -.92026185D-02     .75311949D-
01
                  3     .59871797D+00    -.13948292D-02     .74928525D-
01

             4    0     .00000000D+00    -.24836616D-01     .74928525D-
01
                  1     .59871797D+00    -.89979397D-02     .64765009D-
01
                  2     .93884918D+00     .53125493D-03     .63308495D-
01

             5    0     .00000000D+00    -.29855902D-02     .63308495D-
01
                  1     .93884918D+00     .11622895D-02     .62431769D-
01
                  2     .67577151D+00    -.27210128D-04     .62282952D-
01
```

```
                  6    0     .00000000D+00     -.56363776D-03     .62282952D-
01
                       1     .67577151D+00     -.26446780D-03     .62003181D-
01
                       2     .12731570D+01     -.44719499D-06     .61924071D-
01

                  7    0     .00000000D+00     -.18982698D-03     .61924071D-
01
                       1     .12731570D+01     -.57241964D-04     .61766839D-
01
                       2     .18228271D+01     -.13721961D-06     .61751073D-
01

                  8    0     .00000000D+00     -.74809490D-04     .61751073D-
01
                       1     .18228271D+01      .22298387D-04     .61703247D-
01
                       2     .14042606D+01      .19936067D-07     .61698576D-
01

                  9    0     .00000000D+00     -.19209482D-04     .61698576D-
01
                       1     .14042606D+01      .13843960D-04     .61694834D-
01
                       2     .81610617D+00      .26386059D-07     .61690753D-
01

                 10    0     .00000000D+00     -.36448326D-05     .61690753D-
01
                       1     .81610617D+00      .19892590D-06     .61689347D-
01

                 11    0     .00000000D+00     -.75875786D-06     .61689347D-
01
                       1     .81610617D+00     -.89082311D-07     .61689001D-
01
                       2     .92466714D+00     -.58277367D-11     .61688997D-
01

                 12    0     .00000000D+00     -.98207085D-07     .61688997D-
01
                       1     .92466714D+00      .19778153D-07     .61688960D-
01
                       2     .76966293D+00     -.19111208D-11     .61688959D-
01

                 13    0     .00000000D+00     -.90893007D-08     .61688959D-
01
                       1     .76966293D+00     -.12562443D-08     .61688955D-
01
                       2     .89309938D+00     -.70779302D-13     .61688955D-
01
```

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             14     0      .00000000D+00    -.68765652D-09     .61688955D-
01
                    1      .89309938D+00     .53879908D-10     .61688954D-
01

             15     0      .00000000D+00    -.70531237D-10     .61688954D-
01
                    1      .89309938D+00    -.63981327D-12     .61688954D-
01

             16     0      .00000000D+00    -.56180490D-11     .61688954D-
01
                    1      .89309938D+00     .54692898D-12     .61688954D-
01

UNSPECIFIED TITLE

LISREL ESTIMATES (MAXIMUM LIKELIHOOD)

        LAMBDA Y

                ETA 1      ETA 2      ETA 3      ETA 4      ETA 5       ETA
6
             --------   --------   --------   --------   --------
--------
      AGE     1.000       .000       .000       .000       .000
.000
 PRESTIGE      .000      1.000       .000       .000       .000
.000
 EDUCATIO      .000       .000      1.000       .000       .000
.000
 COMORBID      .000       .000       .000      1.000       .000
.000
     MMSE      .000       .000       .000       .000      1.000
.000
 PRESOCIA      .000       .000       .000       .000       .000
1.000
 PREHEALT      .000       .000       .000       .000       .000
.000
 PRESCORE      .000       .000       .000       .000       .000
.000
 POSTSOCI      .000       .000       .000       .000       .000
.000
 POSTHEAL      .000       .000       .000       .000       .000
.000
 POSTSCOR      .000       .000       .000       .000       .000
.000

        LAMBDA Y

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11       ETA
12
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            ________  ________  ________  ________  ________
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      AGE       .000      .000      .000      .000      .000
 .000
 PRESTIGE       .000      .000      .000      .000      .000
 .000
 EDUCATIO       .000      .000      .000      .000      .000
 .000
 COMORBID       .000      .000      .000      .000      .000
 .000
     MMSE       .000      .000      .000      .000      .000
 .000
 PRESOCIA       .000      .000      .000      .000      .000
 .000
 PREHEALT      1.000      .000      .000      .000      .000
 .000
 PRESCORE       .000     1.000      .000      .000      .000
 .000
 POSTSOCI       .000      .000      .000     1.000      .000
 .000
 POSTHEAL       .000      .000      .000      .000     1.000
 .000
 POSTSCOR       .000      .000      .000      .000      .000
 1.000

         BETA

                ETA 1     ETA 2     ETA 3     ETA 4     ETA 5     ETA
 6
            ________  ________  ________  ________  ________
 ________
    ETA 1       .000      .000      .000      .000      .000
 .000
    ETA 2       .000      .000      .000      .000      .000
 .000
    ETA 3       .000      .000      .000      .000      .000
 .000
    ETA 4       .000      .000      .000      .000      .000
 .000
    ETA 5       .397      .000     2.281      .000      .000
 .000
    ETA 6       .000      .000      .000      .000      .000
 .000
    ETA 7      -.034     -.040      .058      .192      .004      -
 .246
    ETA 8      -.494      .030     1.622    -1.500      .268
 2.248
    ETA 9       .000      .000      .000      .000      .000
 .000
   ETA 10       .000      .000      .000      .000      .003
 .665
   ETA 11       .000     -.015      .000      .080      .007
 .000
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  ETA 12      .000      .000      .000      .000      .539
.000

       BETA

             ETA 7     ETA 8     ETA 9    ETA 10    ETA 11       ETA
12
          --------  --------  --------  --------  --------
--------
   ETA 1      .000      .000      .000      .000      .000
.000
   ETA 2      .000      .000      .000      .000      .000
.000
   ETA 3      .000      .000      .000      .000      .000
.000
   ETA 4      .000      .000      .000      .000      .000
.000
   ETA 5      .000      .000      .000      .000      .000
.000
   ETA 6      .000      .000      .000      .000      .000
.000
   ETA 7      .000     -.018      .000      .000      .000
.000
   ETA 8      .000      .000      .000      .000      .000
.000
   ETA 9      .000     1.000      .000      .000      .000     -
1.000
  ETA 10      .000      .000      .000      .000      .000
.000
  ETA 11      .197      .000      .013     -.068      .000      -
.008
  ETA 12      .000      .572      .000     3.828      .000
.000

       COVARIANCE MATRIX OF ETA

             ETA 1     ETA 2     ETA 3     ETA 4     ETA 5       ETA
6
          --------  --------  --------  --------  --------
--------
   ETA 1    45.437
   ETA 2    -1.063    21.343
   ETA 3      .003     1.812     1.536
   ETA 4     -.349     2.630     -.026     2.088
   ETA 5    18.050     3.711     3.505     -.199   555.536
   ETA 6      .004      .001      .001      .000      .126
.632
   ETA 7    -1.211     -.222     -.040      .358    -1.124      -
.181
   ETA 8   -17.104     1.162     3.526    -2.978   146.295
1.454
   ETA 9   -17.296    -1.553     -.427    -1.165  -244.355     -
1.056
```

```
  ETA 10       .065       .013       .013      -.001      1.993
.421
  ETA 11      -.351      -.179      -.050       .194     -2.689      -
.097
  ETA 12       .192      2.715      3.954     -1.813    390.649
2.510

        COVARIANCE MATRIX OF ETA

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
             --------   --------   --------   --------   --------
--------
   ETA 7       .870
   ETA 8     -7.120    417.938
   ETA 9     -1.966     94.458    562.221
  ETA 10      -.124      1.470     -3.379       .766
  ETA 11       .218     -2.016      9.158      -.145       .823
  ETA 12     -5.153    323.479   -467.763      4.849    -11.175
791.242

        PSI

                ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
             --------   --------   --------   --------   --------
--------
   ETA 1     45.437
   ETA 2     -1.063     21.343
   ETA 3       .003      1.812      1.536
   ETA 4      -.349      2.630      -.026      2.088
   ETA 5       .000       .000       .000       .000    540.373
   ETA 6       .000       .000       .000       .000       .000
.632
   ETA 7       .000       .000       .000       .000       .000
.000
   ETA 8       .000       .000       .000       .000       .000
.000
   ETA 9       .000       .000       .000       .000       .000
.000
  ETA 10       .000       .000       .000       .000       .000
.000
  ETA 11       .000       .000       .000       .000       .000
.000
  ETA 12       .000       .000       .000       .000       .000
.000

        PSI

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
             --------   --------   --------   --------   --------
--------
   ETA 7       .585
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     ETA 8       .000     356.803
     ETA 9       .000        .000        .000
    ETA 10       .000        .000        .000        .480
    ETA 11       .000        .000        .000        .000        .561
    ETA 12       .000        .000        .000        .000        .000
377.177

        THETA EPS

                  AGE    PRESTIGE    EDUCATIO    COMORBID        MMSE
PRESOCIA
             --------    --------    --------    --------    --------

--------
       AGE       .459
  PRESTIGE       .000       5.334
  EDUCATIO       .000        .000        .384
  COMORBID       .000        .000        .000        .522
      MMSE       .000        .000        .000        .000     138.840
  PRESOCIA       .000        .000        .000        .000        .000
.006
  PREHEALT       .000        .000        .000        .000        .000
.000
  PRESCORE       .000        .000        .000        .000        .000
.000
  POSTSOCI       .000        .000        .000        .000        .000
.000
  POSTHEAL       .000        .000        .000        .000        .000
.000
  POSTSCOR       .000        .000        .000        .000        .000
.000

        THETA EPS

             PREHEALT    PRESCORE    POSTSOCI    POSTHEAL    POSTSCOR
             --------    --------    --------    --------    --------
  PREHEALT       .218
  PRESCORE       .000      74.161
  POSTSOCI       .000        .000        .008
  POSTHEAL       .000        .000        .000        .208
  POSTSCOR       .000        .000        .000        .000     141.134

        SQUARED MULTIPLE CORRELATIONS FOR Y - VARIABLES

                  AGE    PRESTIGE    EDUCATIO    COMORBID        MMSE
PRESOCIA
             --------    --------    --------    --------    --------

--------
                 .990        .800        .800        .800        .800
.990

        SQUARED MULTIPLE CORRELATIONS FOR Y - VARIABLES

             PREHEALT    PRESCORE    POSTSOCI    POSTHEAL    POSTSCOR
             --------    --------    --------    --------    --------
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```
              .800      .849      .990      .798      .849

        TOTAL COEFFICIENT OF DETERMINATION FOR Y - VARIABLES IS  1.000

        SQUARED MULTIPLE CORRELATIONS FOR STRUCTURAL EQUATIONS

              ETA 1     ETA 2     ETA 3     ETA 4     ETA 5       ETA
6

           --------  --------  --------  --------  --------

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              .000      .000      .000      .000      .027
.000

        SQUARED MULTIPLE CORRELATIONS FOR STRUCTURAL EQUATIONS

              ETA 7     ETA 8     ETA 9    ETA 10    ETA 11       ETA
12

           --------  --------  --------  --------  --------

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              .328      .146     1.000      .374      .318
.523

W_A_R_N_I_N_G : LAMBDA Y does not have full column rank

W_A_R_N_I_N_G : PSI is not positive definite


         CHI-SQUARE WITH  21 DEGREES OF FREEDOM =     17.77 (P = .664)

                     GOODNESS OF FIT INDEX = .979
            ADJUSTED GOODNESS OF FIT INDEX = .933
                 ROOT MEAN SQUARE RESIDUAL =     2.217

UNSPECIFIED TITLE

        FITTED COVARIANCE MATRIX

                AGE  PRESTIGE  EDUCATIO  COMORBID      MMSE
PRESOCIA

           --------  --------  --------  --------  --------

--------
     AGE     45.896
PRESTIGE     -1.063    26.677
EDUCATIO       .003     1.812     1.921
COMORBID      -.349     2.630     -.026     2.610
    MMSE     18.050     3.711     3.505     -.199   694.376
PRESOCIA       .004      .001      .001      .000      .126
.638
PREHEALT     -1.211     -.222     -.040      .358    -1.124       -
.181
PRESCORE    -17.104     1.162     3.526    -2.978   146.295
1.454
```

```
POSTSOCI        .065        .013        .013       -.001       1.993
.421
POSTHEAL       -.351       -.179       -.050        .194      -2.689      -
.097
POSTSCOR        .192       2.715       3.954      -1.813     390.649
2.510

        FITTED COVARIANCE MATRIX

            PREHEALT    PRESCORE    POSTSOCI    POSTHEAL    POSTSCOR

            ________    ________    ________    ________    ________
PREHEALT       1.088
PRESCORE      -7.120     492.098
POSTSOCI       -.124       1.470        .774
POSTHEAL        .218      -2.016       -.145       1.031
POSTSCOR      -5.153     323.479       4.849     -11.175     932.377

        FITTED RESIDUALS

                 AGE    PRESTIGE    EDUCATIO    COMORBID        MMSE
PRESOCIA

            ________    ________    ________    ________    ________

________
     AGE        .000
PRESTIGE        .004       -.009
EDUCATIO        .000        .018        .000
COMORBID       -.001        .002       -.004        .000
    MMSE        .643      -3.283        .410      -2.924       -.178
PRESOCIA       -.390        .325       -.006       -.040        .060
.000
PREHEALT        .109       -.086       -.006        .012       -.383      -
.007
PRESCORE       -.481       -.314        .128       -.729       1.915
.190
POSTSOCI       -.171        .266       -.040       -.091       -.039
.000
POSTHEAL        .159       -.203        .212        .024       -.223
.082
POSTSCOR      -6.251       7.382      -3.701      -1.787       2.211      -
.416

        FITTED RESIDUALS

            PREHEALT    PRESCORE    POSTSOCI    POSTHEAL    POSTSCOR

            ________    ________    ________    ________    ________
PREHEALT        .002
PRESCORE       -.211       2.308
POSTSOCI       -.129       1.508        .000
POSTHEAL        .019       -.375       -.029        .009
POSTSCOR       -.220      10.117        .804       -.321       8.519


SUMMARY STATISTICS FOR FITTED RESIDUALS
SMALLEST FITTED RESIDUAL =    -6.251
```

```
  MEDIAN FITTED RESIDUAL =      .000
 LARGEST FITTED RESIDUAL =    10.117


STEMLEAF PLOT
- 6|3
- 4|
- 2|739
- 0|8754444332222221110000000000000000000000000
  0|11112223346859
  2|23
  4|
  6|4
  8|5
 10|1

        STANDARDIZED RESIDUALS

                 AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
            ________   ________   ________   ________   ________
________
     AGE        .000
PRESTIGE        .086     -1.330
EDUCATIO        .000      1.074       .114
COMORBID       -.040      1.182      -.588      -.671
    MMSE        .365      -.309       .973      -.835      -.239
PRESOCIA       -.871       .947      -.066      -.371       .339
.000
PREHEALT        .841      -.876      -.211       .396      -.652      -
.352
PRESCORE       -.334      -.128       .428      -.911       .444
.640
POSTSOCI       -.350       .704      -.395      -.768      -.313
.000
POSTHEAL        .313     -1.191      2.031       .465      -.708
1.618
POSTSCOR       -.521       .628     -1.485      -.478       .623      -
.363

        STANDARDIZED RESIDUALS

            PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
            ________   ________   ________   ________   ________
PREHEALT        .208
PRESCORE      -1.048      1.036
POSTSOCI      -2.141      1.225       .000
POSTHEAL        .645     -1.634     -2.117       .715
POSTSCOR       -.124      1.601      1.354      -.752      1.612

SUMMARY STATISTICS FOR STANDARDIZED RESIDUALS
SMALLEST STANDARDIZED RESIDUAL =    -2.141
  MEDIAN STANDARDIZED RESIDUAL =     -.020
 LARGEST STANDARDIZED RESIDUAL =    2.031

STEMLEAF PLOT
- 2|11
- 1|65
- 1|320
- 0|999888777655
- 0|4444333322111000000
  0|112334444
  0|566667789
  1|001224
  1|666
  2|0

UNSPECIFIED TITLE

                        QPLOT OF STANDARDIZED RESIDUALS

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R   .                                          xxx
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M   .                                         xx
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A   .                                       *.x
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Q   .                                  xx
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3.5...........................................................
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  -3.5
3.5
                           STANDARDIZED RESIDUALS

UNSPECIFIED TITLE


STANDARD ERRORS

        BETA

                ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
              ________    ________    ________    ________    ________

________
   ETA 1         .000        .000        .000        .000        .000
.000
   ETA 2         .000        .000        .000        .000        .000
.000
   ETA 3         .000        .000        .000        .000        .000
.000
   ETA 4         .000        .000        .000        .000        .000
.000
   ETA 5         .322        .000       1.943        .000        .000
.000
   ETA 6         .000        .000        .000        .000        .003
.000
   ETA 7         .012        .023        .078        .070        .004
.098
   ETA 8         .264        .525       1.758       1.562        .085
2.216
   ETA 9         .000        .000        .000        .000        .000
.000
  ETA 10         .000        .000        .000        .000        .003
.074
  ETA 11         .000        .021        .000        .072        .005
.000
  ETA 12         .000        .000        .000        .000        .102
.000

        BETA

                ETA 7       ETA 8       ETA 9      ETA 10      ETA 11       ETA
12
              ________    ________    ________    ________    ________

________
   ETA 1         .000        .000        .000        .000        .000
.000
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     ETA 2        .000        .000        .000        .000        .000
 .000
     ETA 3        .000        .000        .000        .000        .000
 .000
     ETA 4        .000        .000        .000        .000        .000
 .000
     ETA 5        .000        .000        .000        .000        .000
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     ETA 6        .000        .000        .000        .000        .000
 .000
     ETA 7        .000        .005        .000        .000        .000
 .000
     ETA 8        .000        .000        .000        .000        .000
 .000
     ETA 9        .000        .000        .000        .000        .000
 .000
    ETA 10        .000        .000        .000        .000        .000
 .000
    ETA 11        .110        .000        .006        .093        .000
 .005
    ETA 12        .000        .114        .000       2.325        .000
 .000

         PSI

                 ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
 6
               ________    ________    ________    ________    ________
 ________
     ETA 1       5.409
     ETA 2       2.917       3.144
     ETA 3        .782        .615        .226
     ETA 4        .912        .729        .186        .308
     ETA 5        .000        .000        .000        .000      80.237
     ETA 6        .000        .000        .000        .000        .000
 .075
     ETA 7        .000        .000        .000        .000        .000
 .000
     ETA 8        .000        .000        .000        .000        .000
 .000
     ETA 9        .000        .000        .000        .000        .000
 .000
    ETA 10        .000        .000        .000        .000        .000
 .000
    ETA 11        .000        .000        .000        .000        .000
 .000
    ETA 12        .000        .000        .000        .000        .000
 .000

         PSI

                 ETA 7       ETA 8       ETA 9      ETA 10      ETA 11      ETA
 12
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                 --------  --------  --------  --------  --------
  --------
     ETA 7         .101
     ETA 8         .000    52.223
     ETA 9         .000      .000      .000
    ETA 10         .000      .000      .000      .058
    ETA 11         .000      .000      .000      .000      .102
    ETA 12         .000      .000      .000      .000      .000
68.645

UNSPECIFIED TITLE

         CORRELATIONS OF ESTIMATES

                 BE 5,1    BE 5,3    BE 6,5    BE 7,1    BE 7,2      BE
7,3
                 --------  --------  --------  --------  --------
  --------
    BE 5,1        1.000
    BE 5,3         .000     1.000
    BE 6,5         .000      .000     1.000
    BE 7,1        -.024      .002      .000     1.000
    BE 7,2         .000      .000      .000      .022     1.000
    BE 7,3         .000     -.020      .000     -.015     -.423
1.000
    BE 7,4         .000      .000      .000      .044     -.505
 .211
    BE 7,5         .003     -.010      .002     -.190      .009      -
 .083
    BE 7,6         .000      .000     -.024     -.021      .001
 .011
    BE 7,8        -.001      .002      .000      .201     -.004      -
 .107
    BE 8,1        -.070      .002      .000      .067      .002
 .000
    BE 8,2         .000      .000      .000      .018      .066      -
 .037
    BE 8,3         .000     -.061      .000     -.008     -.027
 .072
    BE 8,4         .000      .000      .000     -.017     -.033
 .025
    BE 8,5         .000     -.018      .001     -.014      .001      -
 .006
    BE 8,6         .000      .000     -.071      .001      .000
 .000
   BE 10,5        -.003     -.003      .000      .000      .000
 .000
   BE 10,6         .000      .000     -.025      .000      .000
 .000
   BE 11,2         .002     -.009      .001      .003     -.038      -
 .002
   BE 11,4        -.001      .005     -.001     -.004      .010
 .004
 BE 11,5      -.007      -.002       .003      -.001      -.001
.000
 BE 11,7       .007      -.002       .004       .013       .027      -
.010
 BE 11,9       .009      -.004      -.001       .004       .012      -
.004
BE 11,10       .001       .000      -.024       .002       .004      -
.002
BE 11,12       .010      -.003      -.001       .005       .013      -
.003
 BE 12,5      -.022      -.009       .011       .000       .000
.000
 BE 12,8       .023      -.012      -.008       .000       .000
.000
BE 12,10      -.001       .001      -.071       .000       .000
.000
  PS 1,1      -.001       .000       .000       .003       .000
.000
  PS 2,1       .000       .000       .000       .044       .002
.000
  PS 2,2       .000       .000       .000       .000       .055      -
.005
  PS 3,1      -.024      -.001       .000      -.017       .000
.002
  PS 3,2       .001      -.007       .000       .000      -.018
.042
  PS 3,3       .000      -.034       .000       .000       .002      -
.023
  PS 4,1       .000       .000       .000      -.066       .000
.000
  PS 4,2       .000       .000       .000       .000      -.059
.006
  PS 4,3       .001       .000       .000       .000       .007      -
.063
  PS 4,4       .000       .000       .000      -.001       .008      -
.003
  PS 5,5       .001      -.031      -.002       .005       .000
.004
  PS 6,6       .000       .000      -.002       .000       .000
.000
  PS 7,7      -.001       .001       .000       .024       .118      -
.071
  PS 8,8      -.002       .003       .001       .019      -.001      -
.010
PS 10,10       .000       .000      -.001       .000       .000
.000
PS 11,11      -.001       .000       .000      -.001      -.002
.000
PS 12,12       .001       .003      -.001       .000       .000
.001

         CORRELATIONS OF ESTIMATES
```

	BE 7,4	BE 7,5	BE 7,6	BE 7,8	BE 8,1	BE 8,2
BE 7,4	1.000					
BE 7,5	-.045	1.000				
BE 7,6	-.012	.032	1.000			
BE 7,8	.113	-.375	-.105	1.000		
BE 8,1	.002	-.010	.000	.005	1.000	
BE 8,2	-.023	-.025	-.009	.083	.023	1.000
BE 8,3	.009	.006	.005	-.044	.007	-.423
BE 8,4	.055	.028	.010	-.092	.023	-.504
BE 8,5	-.003	.075	.002	-.025	-.129	.008
BE 8,6	.000	-.001	.069	.002	.000	.000
BE 10,5	.000	.001	.002	.000	.000	.000
BE 10,6	.000	.000	.002	.000	.000	.000
BE 11,2	.014	.001	.003	-.003	.002	-.032
BE 11,4	-.033	.003	-.004	.004	-.003	.017
BE 11,5	.003	-.042	.001	.017	-.004	-.006
BE 11,7	-.033	-.009	.013	-.029	.011	-.001
BE 11,9	-.016	.011	.006	-.049	.013	.024
BE 11,10	-.005	-.002	-.031	-.002	.001	-.002
BE 11,12	-.018	.012	.006	-.054	.014	.026
BE 12,5	.000	-.021	.001	.007	-.008	.000
BE 12,8	.000	.008	.001	-.020	.023	.000
BE 12,10	.000	.000	-.013	.001	-.001	.000
PS 1,1	.000	.000	.000	.000	.002	.000
PS 2,1	.000	.000	.000	.000	-.001	.001
PS 2,2	-.006	.000	.000	.000	.000	-.002
PS 3,1	.000	.000	.000	.000	-.021	.000
PS 3,2	.003	.000	.000	-.001	.000	-.019

```
  PS 3,3      -.001      .000      .000      .001      .000
.002
  PS 4,1       .002      .000      .000     -.001      .022
.000
  PS 4,2       .044      .000      .000      .001      .000
.019
  PS 4,3      -.018      .000      .000      .001      .000
.001
  PS 4,4      -.085      .001      .000     -.002      .000      -
.003
  PS 5,5       .000     -.028      .000      .002      .013
.000
  PS 6,6       .000      .000      .003      .000      .000
.000
  PS 7,7      -.123     -.060     -.007      .096      .000
.008
  PS 8,8       .011     -.037     -.010      .098      .014      -
.006
PS 10,10       .000      .000      .000      .000      .000
.000
PS 11,11       .002      .001     -.001      .002     -.001      -
.001
PS 12,12       .000      .000      .000      .000      .000
.000

        CORRELATIONS OF ESTIMATES

            BE 8,3    BE 8,4    BE 8,5    BE 8,6   BE 10,5     BE
10,6
          --------  --------  --------  --------  --------

--------
  BE 8,3     1.000
  BE 8,4      .222     1.000
  BE 8,5     -.133     -.004     1.000
  BE 8,6      .000      .000     -.007     1.000
 BE 10,5      .000      .000      .008      .003     1.000
 BE 10,6      .000      .000      .000      .010     -.008
1.000
 BE 11,2      .001      .018      .003      .001     -.001
.000
 BE 11,4     -.001     -.036     -.003     -.002      .001
.000
 BE 11,5      .002      .007     -.020      .002      .008
.000
 BE 11,7     -.003      .002      .000      .005     -.003      -
.001
 BE 11,9     -.009     -.027     -.032      .000      .001
.000
BE 11,10      .000      .003      .001     -.022     -.035
.004
BE 11,12     -.009     -.030     -.031      .000      .000
.000
 BE 12,5     -.003     -.002     -.002      .003      .020      -
.001
```

```
 BE 12,8       .008       .005      -.111      -.002       .005
.001
BE 12,10       .000       .000       .006      -.027      -.096
.009
  PS 1,1       .000       .000       .000       .000       .000
.000
  PS 2,1       .000       .000       .000       .000       .000
.000
  PS 2,2       .000       .000       .000       .000       .000
.000
  PS 3,1       .001       .000       .000       .000       .000
.000
  PS 3,2       .001       .002       .000       .000       .000
.000
  PS 3,3      -.028      -.001       .001       .000       .000
.000
  PS 4,1       .000       .001       .000       .000       .000
.000
  PS 4,2      -.002      -.003       .000       .000       .000
.000
  PS 4,3       .020      -.020       .000       .000       .000
.000
  PS 4,4       .001       .030       .000       .000       .000
.000
  PS 5,5       .013       .000      -.092       .000      -.036
.000
  PS 6,6       .000       .000       .000       .000       .000      -
.010
  PS 7,7      -.004      -.009      -.002       .000       .000
.000
  PS 8,8      -.014       .030      -.092       .000       .000
.000
PS 10,10       .000       .000       .000       .000      -.035      -
.010
PS 11,11       .000       .002       .002       .000       .000
.000
PS 12,12       .000       .000       .007       .000      -.002
.000

       CORRELATIONS OF ESTIMATES

            BE 11,2    BE 11,4    BE 11,5    BE 11,7    BE 11,9    BE
11,10
            --------   --------   --------   --------   --------
--------
 BE 11,2      1.000
 BE 11,4      -.504      1.000
 BE 11,5      -.040       .017      1.000
 BE 11,7       .224      -.356      -.078      1.000
 BE 11,9       .023      -.019       .095       .352      1.000
BE 11,10       .040      -.065       .046       .167       .122
1.000
BE 11,12       .030      -.023      -.493       .373       .584      -
.055
```

```
 BE 12,5       .000       .000       .171       .000      -.022      -
.005
 BE 12,8       .000       .000      -.026       .000       .159      -
.002
BE 12,10       .000       .000      -.017       .000      -.013
.174
  PS 1,1       .000       .000       .000       .000       .000
.000
  PS 2,1      -.002       .001       .003      -.006      -.005      -
.001
  PS 2,2       .022      -.002       .000       .001       .000
.000
  PS 3,1       .000       .000       .000       .000       .000
.000
  PS 3,2       .006      -.003       .001       .002       .002
.000
  PS 3,3       .000       .000       .000       .000       .000
.000
  PS 4,1       .002      -.002      -.005       .009       .007
.001
  PS 4,2      -.025       .017       .000      -.002       .000
.000
  PS 4,3      -.010       .005      -.002      -.003      -.003
.000
  PS 4,4       .004      -.035       .000       .002       .000
.000
  PS 5,5       .001      -.001      -.048       .000      -.001
.000
  PS 6,6       .000       .000       .000       .000       .000
.000
  PS 7,7      -.014       .023       .006      -.063      -.021      -
.010
  PS 8,8       .003      -.006       .014       .000      -.042
.003
PS 10,10       .000       .000      -.001       .001       .000
.007
PS 11,11       .034      -.035      -.166      -.066      -.189      -
.053
PS 12,12       .000       .000      -.157       .000      -.135      -
.049

          CORRELATIONS OF ESTIMATES

            BE 11,12    BE 12,5    BE 12,8   BE 12,10     PS 1,1      PS
2,1
            --------   --------   --------   --------   --------
--------
BE 11,12       1.000
 BE 12,5       -.072      1.000
 BE 12,8        .139      -.340      1.000
BE 12,10       -.005      -.083      -.055      1.000
  PS 1,1        .000       .000       .000       .000      1.000
  PS 2,1       -.005       .000       .000       .000      -.043
1.000
```

```
    PS 2,2       .000       .000       .000       .000       .001      -
.043
    PS 3,1       .000       .000       .000       .000       .000
.253
    PS 3,2       .002       .000       .000       .000       .000      -
.007
    PS 3,3       .000       .000       .000       .000       .000
.000
    PS 4,1       .008       .000       .000       .000      -.045
.316
    PS 4,2       .000       .000       .000       .000       .001      -
.039
    PS 4,3      -.003       .000       .000       .000       .000      -
.008
    PS 4,4       .000       .000       .000       .000       .001      -
.014
    PS 5,5       .005      -.156       .009       .003       .000
.000
    PS 6,6       .000       .000       .000       .001       .000
.000
    PS 7,7      -.024       .000       .000       .000       .000
.001
    PS 8,8      -.045       .021      -.060       .004       .000
.000
PS 10,10         .000      -.001      -.001       .015       .000
.000
PS 11,11         .035      -.008      -.008       .002       .000
.000
PS 12,12         .095      -.139      -.061       .020       .000
.000

         CORRELATIONS OF ESTIMATES

               PS 2,2     PS 3,1     PS 3,2     PS 3,3     PS 4,1      PS
4,2

             ________   ________   ________   ________   ________

________
    PS 2,2      1.000
    PS 3,1      -.011      1.000
    PS 3,2       .347      -.029      1.000
    PS 3,3       .064       .000       .347      1.000
    PS 4,1      -.014      -.012       .000       .000      1.000
    PS 4,2       .425      -.007       .063      -.004      -.039
1.000
    PS 4,3       .113      -.032       .303      -.017       .001
.238
    PS 4,4       .099       .001      -.005       .000      -.045
.425
    PS 5,5       .000       .000       .000       .001       .000
.000
    PS 6,6       .000       .000       .000       .000       .000
.000
    PS 7,7       .002       .000      -.001       .000      -.001      -
.004
```

```
  PS 8,8       .000       .000       .000       .000       .000
.000
PS 10,10       .000       .000       .000       .000       .000
.000
PS 11,11       .000       .000       .000       .000      -.001      -
.001
PS 12,12       .000       .000       .000       .000       .000
.000

       CORRELATIONS OF ESTIMATES

            PS 4,3     PS 4,4     PS 5,5     PS 6,6     PS 7,7     PS
8,8
          --------   --------   --------   --------   --------
--------
  PS 4,3     1.000
  PS 4,4     -.017      1.000
  PS 5,5      .000       .000      1.000
  PS 6,6      .000       .000       .000      1.000
  PS 7,7      .002       .005       .001       .000      1.000
  PS 8,8     -.001       .001       .004       .000       .004
1.000
PS 10,10      .000       .000       .001       .000       .000
.000
PS 11,11      .000       .001       .002       .000       .001
.001
PS 12,12      .000       .000       .013       .000       .000
.002

       CORRELATIONS OF ESTIMATES

          PS 10,10   PS 11,11   PS 12,12
          --------   --------   --------
PS 10,10     1.000
PS 11,11      .000      1.000
PS 12,12      .000       .033      1.000

UNSPECIFIED TITLE


T-VALUES

       BETA

             ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
          --------   --------   --------   --------   --------
--------
   ETA 1      .000       .000       .000       .000       .000
.000
   ETA 2      .000       .000       .000       .000       .000
.000
   ETA 3      .000       .000       .000       .000       .000
.000
```

```
      ETA 4       .000        .000        .000        .000        .000       
.000
      ETA 5      1.233        .000       1.174        .000        .000       
.000
      ETA 6       .000        .000        .000        .000        .072       
.000
      ETA 7     -2.902      -1.734        .739       2.755        .971      -
2.519
      ETA 8     -1.873        .058        .923       -.961       3.158       
1.015
      ETA 9       .000        .000        .000        .000        .000       
.000
     ETA 10       .000        .000        .000        .000       1.247       
8.996
     ETA 11       .000       -.724        .000       1.112       1.473       
.000
     ETA 12       .000        .000        .000        .000       5.259       
.000

         BETA

                 ETA 7       ETA 8       ETA 9      ETA 10      ETA 11        ETA
12
              --------    --------    --------    --------    --------    
--------
      ETA 1       .000        .000        .000        .000        .000       
.000
      ETA 2       .000        .000        .000        .000        .000       
.000
      ETA 3       .000        .000        .000        .000        .000       
.000
      ETA 4       .000        .000        .000        .000        .000       
.000
      ETA 5       .000        .000        .000        .000        .000       
.000
      ETA 6       .000        .000        .000        .000        .000       
.000
      ETA 7       .000      -3.932        .000        .000        .000       
.000
      ETA 8       .000        .000        .000        .000        .000       
.000
      ETA 9       .000        .000        .000        .000        .000       
.000
     ETA 10       .000        .000        .000        .000        .000       
.000
     ETA 11      1.795        .000       2.292       -.729        .000      -
1.538
     ETA 12       .000       5.020        .000       1.647        .000       
.000

         PSI

                 ETA 1       ETA 2       ETA 3       ETA 4       ETA 5        ETA
6
```

```
                ________  ________  ________  ________  ________

________
   ETA 1       8.400
   ETA 2       -.364     6.789
   ETA 3        .004     2.946     6.787
   ETA 4       -.382     3.607     -.142     6.788
   ETA 5        .000      .000      .000      .000     6.735
   ETA 6        .000      .000      .000      .000      .000
8.400
   ETA 7        .000      .000      .000      .000      .000
.000
   ETA 8        .000      .000      .000      .000      .000
.000
   ETA 9        .000      .000      .000      .000      .000
.000
  ETA 10        .000      .000      .000      .000      .000
.000
  ETA 11        .000      .000      .000      .000      .000
.000
  ETA 12        .000      .000      .000      .000      .000
.000

        PSI

                 ETA 7     ETA 8     ETA 9    ETA 10    ETA 11      ETA
12

                ________  ________  ________  ________  ________

________
   ETA 7       5.782
   ETA 8        .000     6.832
   ETA 9        .000      .000      .000
  ETA 10        .000      .000      .000     8.276
  ETA 11        .000      .000      .000      .000     5.499
  ETA 12        .000      .000      .000      .000      .000
5.495

UNSPECIFIED TITLE


TOTAL AND INDIRECT EFFECTS

        TOTAL EFFECTS OF ETA ON  ETA

                 ETA 1     ETA 2     ETA 3     ETA 4     ETA 5      ETA
6

                ________  ________  ________  ________  ________

________
   ETA 1        .000      .000      .000      .000      .000
.000
   ETA 2        .000      .000      .000      .000      .000
.000
   ETA 3        .000      .000      .000      .000      .000
.000
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```
   ETA 4       .000       .000       .000       .000       .000
.000
   ETA 5       .397       .000      2.281       .000       .000
.000
   ETA 6       .000       .000       .001       .000       .000
.000
   ETA 7      -.026      -.041       .026       .219      -.001      -
.286
   ETA 8      -.387       .030      2.235     -1.500       .268
2.248
   ETA 9      -.385       .013      -.304      -.642      -.438     -
1.583
  ETA 10       .001       .000       .008       .000       .004
.665
  ETA 11      -.007      -.023      -.003       .121      -.005      -
.153
  ETA 12      -.002       .017      2.538      -.858       .706
3.831

        TOTAL EFFECTS OF ETA ON  ETA

             ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
          --------   --------   --------   --------   --------
--------
   ETA 1       .000       .000       .000       .000       .000
.000
   ETA 2       .000       .000       .000       .000       .000
.000
   ETA 3       .000       .000       .000       .000       .000
.000
   ETA 4       .000       .000       .000       .000       .000
.000
   ETA 5       .000       .000       .000       .000       .000
.000
   ETA 6       .000       .000       .000       .000       .000
.000
   ETA 7       .000      -.018       .000       .000       .000
.000
   ETA 8       .000       .000       .000       .000       .000
.000
   ETA 9       .000       .428       .000     -3.828       .000     -
1.000
  ETA 10       .000       .000       .000       .000       .000
.000
  ETA 11       .197      -.002       .013      -.149       .000      -
.021
  ETA 12       .000       .572       .000      3.828       .000
.000

   LARGEST EIGENVALUE OF B*B' (STABILITY INDEX) IS  15.310

        STANDARD ERRORS FOR TOTAL EFFECTS OF ETA ON  ETA
```

```
                 ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
              --------   --------   --------   --------   --------
--------
   ETA 1        .000       .000       .000       .000       .000
.000
   ETA 2        .000       .000       .000       .000       .000
.000
   ETA 3        .000       .000       .000       .000       .000
.000
   ETA 4        .000       .000       .000       .000       .000
.000
   ETA 5        .322       .000      1.943       .000       .000
.000
   ETA 6        .001       .000       .007       .000       .003
.000
   ETA 7        .012       .025       .081       .073       .004
.102
   ETA 8        .270       .525      1.787      1.562       .085
2.215
   ETA 9        .198       .225      1.198       .691       .105
1.864
  ETA 10        .002       .000       .011       .000       .003
.074
  ETA 11        .005       .021       .022       .067       .004
.068
  ETA 12        .270       .300      1.662       .908       .107
2.001

       STANDARD ERRORS FOR TOTAL EFFECTS OF ETA ON  ETA

                 ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
12
              --------   --------   --------   --------   --------
--------
   ETA 1        .000       .000       .000       .000       .000
.000
   ETA 2        .000       .000       .000       .000       .000
.000
   ETA 3        .000       .000       .000       .000       .000
.000
   ETA 4        .000       .000       .000       .000       .000
.000
   ETA 5        .000       .000       .000       .000       .000
.000
   ETA 6        .000       .000       .000       .000       .000
.000
   ETA 7        .000       .005       .000       .000       .000
.000
   ETA 8        .000       .000       .000       .000       .000
.000
   ETA 9        .000       .114       .000      2.325       .000
.000
```

```
  ETA 10        .000        .000        .000        .000        .000
.000
  ETA 11        .110        .005        .006        .095        .000
.005
  ETA 12        .000        .114        .000       2.325        .000
.000

         INDIRECT EFFECTS OF ETA ON  ETA

                 ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
               ________    ________    ________    ________    ________
________
   ETA 1        .000        .000        .000        .000        .000
.000
   ETA 2        .000        .000        .000        .000        .000
.000
   ETA 3        .000        .000        .000        .000        .000
.000
   ETA 4        .000        .000        .000        .000        .000
.000
   ETA 5        .000        .000        .000        .000        .000
.000
   ETA 6        .000        .000        .001        .000        .000
.000
   ETA 7        .008       -.001       -.031        .027       -.005          -
.040
   ETA 8        .107        .000        .612        .000        .001
.000
   ETA 9       -.385        .013       -.304       -.642       -.438          -
1.583
  ETA 10        .001        .000        .008        .000        .000
.000
  ETA 11       -.007       -.008       -.003        .041       -.012          -
.153
  ETA 12       -.002        .017       2.538       -.858        .167
3.831

         INDIRECT EFFECTS OF ETA ON  ETA

                 ETA 7       ETA 8       ETA 9      ETA 10      ETA 11       ETA
12
               ________    ________    ________    ________    ________
________
   ETA 1        .000        .000        .000        .000        .000
.000
   ETA 2        .000        .000        .000        .000        .000
.000
   ETA 3        .000        .000        .000        .000        .000
.000
   ETA 4        .000        .000        .000        .000        .000
.000
   ETA 5        .000        .000        .000        .000        .000
.000
```

```
   ETA 6        .000        .000        .000        .000        .000
.000
   ETA 7        .000        .000        .000        .000        .000
.000
   ETA 8        .000        .000        .000        .000        .000
.000
   ETA 9        .000       -.572        .000      -3.828        .000
.000
  ETA 10        .000        .000        .000        .000        .000
.000
  ETA 11        .000       -.002        .000       -.081        .000       -
.013
  ETA 12        .000        .000        .000        .000        .000
.000

        STANDARD ERRORS FOR INDIRECT EFFECTS OF ETA ON  ETA

              ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
             --------    --------    --------    --------    --------
--------
   ETA 1        .000        .000        .000        .000        .000
.000
   ETA 2        .000        .000        .000        .000        .000
.000
   ETA 3        .000        .000        .000        .000        .000
.000
   ETA 4        .000        .000        .000        .000        .000
.000
   ETA 5        .000        .000        .000        .000        .000
.000
   ETA 6        .001        .000        .007        .000        .000
.000
   ETA 7        .005        .009        .033        .028        .002
.041
   ETA 8        .093        .000        .553        .000        .007
.000
   ETA 9        .198        .225       1.198        .691        .105
1.864
  ETA 10        .002        .000        .011        .000        .002
.000
  ETA 11        .005        .006        .022        .026        .004
.068
  ETA 12        .270        .300       1.662        .908        .057
2.001

        STANDARD ERRORS FOR INDIRECT EFFECTS OF ETA ON  ETA

              ETA 7       ETA 8       ETA 9      ETA 10      ETA 11       ETA
12
             --------    --------    --------    --------    --------
--------
   ETA 1        .000        .000        .000        .000        .000
.000
```

```
   ETA 2        .000       .000       .000       .000       .000
.000
   ETA 3        .000       .000       .000       .000       .000
.000
   ETA 4        .000       .000       .000       .000       .000
.000
   ETA 5        .000       .000       .000       .000       .000
.000
   ETA 6        .000       .000       .000       .000       .000
.000
   ETA 7        .000       .000       .000       .000       .000
.000
   ETA 8        .000       .000       .000       .000       .000
.000
   ETA 9        .000       .114       .000      2.325       .000
.000
  ETA 10        .000       .000       .000       .000       .000
.000
  ETA 11        .000       .005       .000       .053       .000
.006
  ETA 12        .000       .000       .000       .000       .000
.000

       TOTAL EFFECTS OF ETA ON  Y

               ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
             --------   --------   --------   --------   --------
--------
     AGE      1.000       .000       .000       .000       .000
.000
PRESTIGE       .000      1.000       .000       .000       .000
.000
EDUCATIO       .000       .000      1.000       .000       .000
.000
COMORBID       .000       .000       .000      1.000       .000
.000
    MMSE       .397       .000      2.281       .000      1.000
.000
PRESOCIA       .000       .000       .001       .000       .000
1.000
PREHEALT      -.026      -.041       .026       .219      -.001        -
.286
PRESCORE      -.387       .030      2.235     -1.500       .268
2.248
POSTSOCI       .001       .000       .008       .000       .004
.665
POSTHEAL      -.007      -.023      -.003       .121      -.005        -
.153
POSTSCOR      -.002       .017      2.538      -.858       .706
3.831

       TOTAL EFFECTS OF ETA ON  Y
```

```
            ETA 7      ETA 8      ETA 9      ETA 10     ETA 11     ETA
12
          --------   --------   --------   --------   --------
--------
     AGE     .000       .000       .000       .000       .000
.000
PRESTIGE     .000       .000       .000       .000       .000
.000
EDUCATIO     .000       .000       .000       .000       .000
.000
COMORBID     .000       .000       .000       .000       .000
.000
    MMSE     .000       .000       .000       .000       .000
.000
PRESOCIA     .000       .000       .000       .000       .000
.000
PREHEALT    1.000      -.018       .000       .000       .000
.000
PRESCORE     .000      1.000       .000       .000       .000
.000
POSTSOCI     .000       .000       .000      1.000       .000
.000
POSTHEAL     .197      -.002       .013      -.149      1.000      -
.021
POSTSCOR     .000       .572       .000      3.828       .000
1.000

        STANDARD ERRORS FOR TOTAL EFFECTS OF ETA ON  Y

            ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
          --------   --------   --------   --------   --------
--------
     AGE     .000       .000       .000       .000       .000
.000
PRESTIGE     .000       .000       .000       .000       .000
.000
EDUCATIO     .000       .000       .000       .000       .000
.000
COMORBID     .000       .000       .000       .000       .000
.000
    MMSE     .322       .000      1.943       .000       .000
.000
PRESOCIA     .001       .000       .007       .000       .003
.000
PREHEALT     .012       .025       .081       .073       .004
.102
PRESCORE     .270       .525      1.787      1.562       .085
2.215
POSTSOCI     .002       .000       .011       .000       .003
.074
POSTHEAL     .005       .021       .022       .067       .004
.068
```

```
POSTSCOR        .270        .300       1.662        .908        .107
2.001

         STANDARD ERRORS FOR TOTAL EFFECTS OF ETA ON  Y

                ETA 7       ETA 8       ETA 9      ETA 10      ETA 11      ETA
12
              --------    --------    --------    --------    --------
--------
     AGE        .000        .000        .000        .000        .000
.000
PRESTIGE        .000        .000        .000        .000        .000
.000
EDUCATIO        .000        .000        .000        .000        .000
.000
COMORBID        .000        .000        .000        .000        .000
.000
    MMSE        .000        .000        .000        .000        .000
.000
PRESOCIA        .000        .000        .000        .000        .000
.000
PREHEALT        .000        .005        .000        .000        .000
.000
PRESCORE        .000        .000        .000        .000        .000
.000
POSTSOCI        .000        .000        .000        .000        .000
.000
POSTHEAL        .110        .005        .006        .095        .000
.005
POSTSCOR        .000        .114        .000       2.325        .000
.000

         INDIRECT EFFECTS OF ETA ON  Y

                ETA 1       ETA 2       ETA 3       ETA 4       ETA 5      ETA
6
              --------    --------    --------    --------    --------
--------
     AGE        .000        .000        .000        .000        .000
.000
PRESTIGE        .000        .000        .000        .000        .000
.000
EDUCATIO        .000        .000        .000        .000        .000
.000
COMORBID        .000        .000        .000        .000        .000
.000
    MMSE        .397        .000       2.281        .000        .000
.000
PRESOCIA        .000        .000        .001        .000        .000
.000
PREHEALT       -.026       -.041        .026        .219       -.001       -
.286
PRESCORE       -.387        .030       2.235      -1.500        .268
2.248
```

```
POSTSOCI       .001        .000        .008        .000        .004
.665
POSTHEAL      -.007       -.023       -.003        .121       -.005        -
.153
POSTSCOR      -.002        .017       2.538       -.858        .706
3.831

        INDIRECT EFFECTS OF ETA ON  Y

              ETA 7       ETA 8       ETA 9       ETA 10      ETA 11       ETA
12
            ________    ________    ________    ________    ________
________
     AGE       .000        .000        .000        .000        .000
.000
PRESTIGE       .000        .000        .000        .000        .000
.000
EDUCATIO       .000        .000        .000        .000        .000
.000
COMORBID       .000        .000        .000        .000        .000
.000
    MMSE       .000        .000        .000        .000        .000
.000
PRESOCIA       .000        .000        .000        .000        .000
.000
PREHEALT       .000       -.018        .000        .000        .000
.000
PRESCORE       .000        .000        .000        .000        .000
.000
POSTSOCI       .000        .000        .000        .000        .000
.000
POSTHEAL       .197       -.002        .013       -.149        .000        -
.021
POSTSCOR       .000        .572        .000       3.828        .000
.000

        STANDARD ERRORS FOR INDIRECT EFFECTS OF ETA ON  Y

              ETA 1       ETA 2       ETA 3       ETA 4       ETA 5        ETA
6
            ________    ________    ________    ________    ________
________
     AGE       .000        .000        .000        .000        .000
.000
PRESTIGE       .000        .000        .000        .000        .000
.000
EDUCATIO       .000        .000        .000        .000        .000
.000
COMORBID       .000        .000        .000        .000        .000
.000
    MMSE       .322        .000       1.943        .000        .000
.000
PRESOCIA       .001        .000        .007        .000        .003
.000
```

```
PREHEALT      .012       .025       .081       .073       .004
.102
PRESCORE      .270       .525      1.787      1.562       .085
2.215
POSTSOCI      .002       .000       .011       .000       .003
.074
POSTHEAL      .005       .021       .022       .067       .004
.068
POSTSCOR      .270       .300      1.662       .908       .107
2.001

        STANDARD ERRORS FOR INDIRECT EFFECTS OF ETA ON  Y

             ETA 7      ETA 8      ETA 9     ETA 10     ETA 11       ETA
12
          ________   ________   ________   ________   ________
________
     AGE      .000       .000       .000       .000       .000
.000
PRESTIGE      .000       .000       .000       .000       .000
.000
EDUCATIO      .000       .000       .000       .000       .000
.000
COMORBID      .000       .000       .000       .000       .000
.000
    MMSE      .000       .000       .000       .000       .000
.000
PRESOCIA      .000       .000       .000       .000       .000
.000
PREHEALT      .000       .005       .000       .000       .000
.000
PRESCORE      .000       .000       .000       .000       .000
.000
POSTSOCI      .000       .000       .000       .000       .000
.000
POSTHEAL      .110       .005       .006       .095       .000
.005
POSTSCOR      .000       .114       .000      2.325       .000
.000

UNSPECIFIED TITLE

COVARIANCES

        Y - ETA

               AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
          ________   ________   ________   ________   ________
________
   ETA 1    45.437     -1.063       .003      -.349     18.050
.004
```

```
   ETA 2     -1.063      21.343       1.812       2.630       3.711
.001
   ETA 3       .003       1.812       1.536       -.026       3.505
.001
   ETA 4      -.349       2.630       -.026       2.088       -.199
.000
   ETA 5     18.050       3.711       3.505       -.199     555.536
.126
   ETA 6       .004        .001        .001        .000        .126
.632
   ETA 7     -1.211       -.222       -.040        .358      -1.124          -
.181
   ETA 8    -17.104       1.162       3.526      -2.978     146.295
1.454
   ETA 9    -17.296      -1.553       -.427      -1.165    -244.355         -
1.056
  ETA 10       .065        .013        .013       -.001       1.993
.421
  ETA 11      -.351       -.179       -.050        .194      -2.689          -
.097
  ETA 12       .192       2.715       3.954      -1.813     390.649
2.510

        Y - ETA

           PREHEALT    PRESCORE    POSTSOCI    POSTHEAL    POSTSCOR
           --------    --------    --------    --------    --------
   ETA 1     -1.211     -17.104        .065       -.351        .192
   ETA 2      -.222       1.162        .013       -.179       2.715
   ETA 3      -.040       3.526        .013       -.050       3.954
   ETA 4       .358      -2.978       -.001        .194      -1.813
   ETA 5     -1.124     146.295       1.993      -2.689     390.649
   ETA 6      -.181       1.454        .421       -.097       2.510
   ETA 7       .870      -7.120       -.124        .218      -5.153
   ETA 8     -7.120     417.938       1.470      -2.016     323.479
   ETA 9     -1.966      94.458      -3.379       9.158    -467.763
  ETA 10      -.124       1.470        .766       -.145       4.849
  ETA 11       .218      -2.016       -.145        .823     -11.175
  ETA 12     -5.153     323.479       4.849     -11.175     791.242

UNSPECIFIED TITLE


FIRST ORDER DERIVATIVES

        LAMBDA Y

              ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
           --------    --------    --------    --------    --------

--------
      AGE      .000       -.001        .000       -.001        .006
.008
```

```
 PRESTIGE      -.001       .000      -.002       .000      -.029       -
 .017
 EDUCATIO       .000      -.008       .000      -.008       .050
 .019
 COMORBID       .003       .000       .011       .000       .929
 .039
     MMSE      -.005       .009      -.002       .004       .000
 .000
 PRESOCIA       .718      -.311      -.036      -.042       .000
 .000
 PREHEALT       .008       .000       .028       .000       .000
 .019
 PRESCORE      -.005       .005      -.001       .001       .000
 .000
 POSTSOCI      -.214      -.048       .020       .113       .000       -
 .013
 POSTHEAL      -.041       .000      -.144       .000       .000       -
 .096
 POSTSCOR       .009      -.009       .003      -.001       .000
 .000

         LAMBDA Y

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11      ETA
 12

              --------   --------   --------   --------   --------
 --------
      AGE      -.003       .023      -.080       .006      -.004
 .103
 PRESTIGE       .005      -.043       .421      -.015       .016       -
 .464
 EDUCATIO      -.007       .068     -2.084       .039      -.110
 2.152
 COMORBID      -.010       .319      -.865       .034      -.023
 1.184
     MMSE       .000       .003       .006       .000       .000       -
 .003
 PRESOCIA      -.133      1.326      -.985       .034      -.198
 2.311
 PREHEALT       .000       .000      -.035       .107      -.024
 .035
 PRESCORE       .000       .000       .022      -.001       .001       -
 .022
 POSTSOCI       .212     -2.532      -.258       .000       .141       -
 2.274
 POSTHEAL       .000       .000       .000       .000       .000
 .000
 POSTSCOR      -.001       .000       .000       .000       .000
 .000

         BETA

                ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
 6
```

```
                --------  --------  --------  --------  --------
 --------
   ETA 1       .000      .000      .000      .000      .006
.008
   ETA 2       .000      .000      .000      .000     -.029      -
.016
   ETA 3       .000      .000      .000      .000      .050
.018
   ETA 4       .000      .000      .000      .000      .929
.031
   ETA 5       .000      .004      .000      .003      .000
.000
   ETA 6       .603     -.366     -.002      .031      .000
.000
   ETA 7       .000      .000      .000      .000      .000
.000
   ETA 8       .000      .000      .000      .000      .000
.000
   ETA 9      -.001      .000     -.002      .000      .000      -
.001
  ETA 10      -.173     -.082      .052      .110      .000
.000
  ETA 11      -.041      .000     -.144      .000      .000      -
.096
  ETA 12       .010     -.009      .006     -.001      .000
.002

         BETA

              ETA 7     ETA 8     ETA 9    ETA 10    ETA 11       ETA
12
                --------  --------  --------  --------  --------
 --------
   ETA 1      -.002      .020     -.086      .004     -.003
.106
   ETA 2       .005     -.043      .423     -.019      .017      -
.466
   ETA 3      -.005      .055    -2.024      .040     -.107
2.079
   ETA 4      -.010      .319     -.906      .060     -.029
1.225
   ETA 5       .001     -.006      .011      .000      .001      -
.016
   ETA 6       .006     -.358    -1.096      .000     -.096
.739
   ETA 7       .000      .000     -.035      .107     -.024
.035
   ETA 8       .000      .000      .023     -.003      .001      -
.023
   ETA 9       .000      .000      .000      .000      .000
.000
  ETA 10       .209    -2.532     -.258      .000      .140      -
2.274
```

```
  ETA 11       .000        .000        .000        .000        .000
.000
  ETA 12      -.001        .000        .000        .000        .000
.000

        PSI

                ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
             --------    --------    --------    --------    --------
--------
   ETA 1       .000
   ETA 2       .000        .000
   ETA 3       .000        .000        .000
   ETA 4       .000        .000        .000        .000
   ETA 5       .000        .000        .000        .002        .000
   ETA 6       .013       -.025        .029        .049        .000
.000
   ETA 7       .000        .000        .000        .000        .000
.000
   ETA 8       .000        .000        .000        .000        .000
.000
   ETA 9       .000        .000       -.001        .000        .000         -
.002
  ETA 10      -.004       -.018        .056        .075        .000
.000
  ETA 11      -.001        .011       -.107       -.015        .001         -
.151
  ETA 12       .000       -.001        .005        .001        .000
.003

        PSI

                ETA 7       ETA 8       ETA 9      ETA 10      ETA 11       ETA
12
             --------    --------    --------    --------    --------
--------
   ETA 7       .000
   ETA 8       .000        .000
   ETA 9       .000        .000        .000
  ETA 10       .223       -.007        .002        .000
  ETA 11      -.028        .001        .000        .133        .000
  ETA 12      -.001        .000        .000       -.002        .000
.000

        THETA EPS

                  AGE    PRESTIGE    EDUCATIO    COMORBID        MMSE
PRESOCIA
             --------    --------    --------    --------    --------
--------
      AGE      .000
 PRESTIGE      .000        .000
 EDUCATIO      .000       -.002        .000
```

```
COMORBID       -.001      -.001       .005       .001
    MMSE        .000       .000      -.002       .001       .000
PRESOCIA        .013      -.023      -.007       .054      -.002      -
.047
PREHEALT        .000      -.002       .021       .004       .000      -
.099
PRESCORE        .000       .000      -.001      -.001       .000
.003
POSTSOCI        .000      -.003       .028       .007       .001
.039
POSTHEAL       -.001       .010      -.108      -.008       .000      -
.249
POSTSCOR        .000      -.001       .003       .001       .000      -
.002

        THETA EPS

            PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
            --------   --------   --------   --------   --------
PREHEALT        .006
PRESCORE        .001       .000
POSTSOCI        .199      -.003       .017
POSTHEAL       -.028       .001       .133       .000
POSTSCOR       -.002       .000       .001       .000       .000

UNSPECIFIED TITLE


FACTOR SCORES REGRESSIONS

        ETA

                 AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
            --------   --------   --------   --------   --------
--------
   ETA 1        .989      -.001       .001       .001       .000      -
.004
   ETA 2       -.009       .756       .233       .271       .001      -
.041
   ETA 3        .001       .017       .780      -.019       .001
.000
   ETA 4        .001       .026      -.026       .759       .000
.025
   ETA 5        .126       .024       .226      -.021       .729      -
.480
   ETA 6        .000       .000       .000       .000       .000
.984
   ETA 7       -.008      -.006       .007       .034       .001      -
.064
   ETA 8       -.119      -.023       .255      -.056       .008
.047
   ETA 9       -.114       .007       .184      -.211      -.109
.133
```

```
  ETA 10        .000        .000        .000        .000        .000
.010
  ETA 11       -.001       -.003        .000        .016        .001       -
.003
  ETA 12       -.006       -.029        .071        .155        .117       -
.086

        ETA

            PREHEALT    PRESCORE    POSTSOCI    POSTHEAL    POSTSCOR
            ________    ________    ________    ________    ________
   ETA 1       -.017       -.001        .000       -.001        .000
   ETA 2       -.149       -.002       -.006       -.071       -.001
   ETA 3        .013        .001        .000        .000        .000
   ETA 4        .082        .000        .004        .040        .001
   ETA 5        .375        .015        .358        .560        .115
   ETA 6       -.002        .000        .009        .000        .000
   ETA 7        .736       -.004        .004        .038        .000
   ETA 8      -1.361        .775       -.179        .634        .074
   ETA 9      -1.583        .633       -.996       3.075       -.644
  ETA 10        .000        .000        .984       -.001        .000
  ETA 11        .036        .002       -.022        .750       -.004
  ETA 12        .223        .142        .817      -2.441        .718

UNSPECIFIED TITLE


STANDARDIZED SOLUTION

        LAMBDA Y

               ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
            ________    ________    ________    ________    ________
________
     AGE       6.741        .000        .000        .000        .000
.000
PRESTIGE        .000       4.620        .000        .000        .000
.000
EDUCATIO        .000        .000       1.239        .000        .000
.000
COMORBID        .000        .000        .000       1.445        .000
.000
    MMSE        .000        .000        .000        .000      23.570
.000
PRESOCIA        .000        .000        .000        .000        .000
.795
PREHEALT        .000        .000        .000        .000        .000
.000
PRESCORE        .000        .000        .000        .000        .000
.000
POSTSOCI        .000        .000        .000        .000        .000
.000
```

```
POSTHEAL        .000       .000       .000       .000       .000
.000
POSTSCOR        .000       .000       .000       .000       .000
.000

         LAMBDA Y

                ETA 7      ETA 8      ETA 9     ETA 10     ETA 11       ETA
12
              --------   --------   --------   --------   --------
--------
     AGE        .000       .000       .000       .000       .000
.000
PRESTIGE        .000       .000       .000       .000       .000
.000
EDUCATIO        .000       .000       .000       .000       .000
.000
COMORBID        .000       .000       .000       .000       .000
.000
    MMSE        .000       .000       .000       .000       .000
.000
PRESOCIA        .000       .000       .000       .000       .000
.000
PREHEALT        .933       .000       .000       .000       .000
.000
PRESCORE        .000     20.444       .000       .000       .000
.000
POSTSOCI        .000       .000       .000       .875       .000
.000
POSTHEAL        .000       .000       .000       .000       .907
.000
POSTSCOR        .000       .000       .000       .000       .000
28.129

         BETA

                ETA 1      ETA 2      ETA 3      ETA 4      ETA 5       ETA
6
              --------   --------   --------   --------   --------
--------
   ETA 1        .000       .000       .000       .000       .000
.000
   ETA 2        .000       .000       .000       .000       .000
.000
   ETA 3        .000       .000       .000       .000       .000
.000
   ETA 4        .000       .000       .000       .000       .000
.000
   ETA 5        .114       .000       .120       .000       .000
.000
   ETA 6        .000       .000       .000       .000       .007
.000
   ETA 7       -.249      -.200       .077       .297       .097        -
.210
```

```
   ETA 8       -.163        .007        .098       -.106        .309
.087
   ETA 9        .000        .000        .000        .000        .000
.000
  ETA 10        .000        .000        .000        .000        .093
.604
  ETA 11        .000       -.078        .000        .127        .192
.000
  ETA 12        .000        .000        .000        .000        .452
.000

         BETA

               ETA 7       ETA 8       ETA 9      ETA 10      ETA 11       ETA
12
            ________    ________    ________    ________    ________
________
   ETA 1        .000        .000        .000        .000        .000
.000
   ETA 2        .000        .000        .000        .000        .000
.000
   ETA 3        .000        .000        .000        .000        .000
.000
   ETA 4        .000        .000        .000        .000        .000
.000
   ETA 5        .000        .000        .000        .000        .000
.000
   ETA 6        .000        .000        .000        .000        .000
.000
   ETA 7        .000       -.393        .000        .000        .000
.000
   ETA 8        .000        .000        .000        .000        .000
.000
   ETA 9        .000        .862        .000        .000        .000       -
1.186
  ETA 10        .000        .000        .000        .000        .000
.000
  ETA 11        .202        .000        .346       -.065        .000       -
.249
  ETA 12        .000        .416        .000        .119        .000
.000

         CORRELATION MATRIX OF ETA

               ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
            ________    ________    ________    ________    ________
________
   ETA 1       1.000
   ETA 2       -.034       1.000
   ETA 3        .000        .316       1.000
   ETA 4       -.036        .394       -.015       1.000
   ETA 5        .114        .034        .120       -.006       1.000
   ETA 6       .001        .000        .001        .000        .007
1.000
   ETA 7      -.193       -.052       -.034        .266       -.051        -
.244
   ETA 8      -.124        .012        .139       -.101        .304
.089
   ETA 9      -.108       -.014       -.015       -.034       -.437        -
.056
  ETA 10       .011        .003        .012       -.001        .097
.604
  ETA 11      -.057       -.043       -.045        .148       -.126        -
.135
  ETA 12       .001        .021        .113       -.045        .589
.112

        CORRELATION MATRIX OF ETA

               ETA 7       ETA 8       ETA 9      ETA 10      ETA 11       ETA
12
            --------    --------    --------    --------    --------
--------
   ETA 7      1.000
   ETA 8      -.373       1.000
   ETA 9      -.089        .195       1.000
  ETA 10      -.152        .082       -.163       1.000
  ETA 11       .258       -.109        .426       -.183       1.000
  ETA 12      -.196        .563       -.701        .197       -.438
1.000

        PSI

               ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
            --------    --------    --------    --------    --------
--------
   ETA 1      1.000
   ETA 2      -.034       1.000
   ETA 3       .000        .316       1.000
   ETA 4      -.036        .394       -.015       1.000
   ETA 5       .000        .000        .000        .000        .973
   ETA 6       .000        .000        .000        .000        .000
1.000
   ETA 7       .000        .000        .000        .000        .000
.000
   ETA 8       .000        .000        .000        .000        .000
.000
   ETA 9       .000        .000        .000        .000        .000
.000
  ETA 10       .000        .000        .000        .000        .000
.000
  ETA 11       .000        .000        .000        .000        .000
.000
  ETA 12       .000        .000        .000        .000        .000
.000
```

```
        PSI

             ETA 7       ETA 8       ETA 9      ETA 10      ETA 11      ETA
12
           --------    --------    --------    --------    --------
--------
   ETA 7      .672
   ETA 8      .000        .854
   ETA 9      .000        .000        .000
  ETA 10      .000        .000        .000        .626
  ETA 11      .000        .000        .000        .000        .682
  ETA 12      .000        .000        .000        .000        .000
.477

UNSPECIFIED TITLE


MODIFICATION INDICES AND ESTIMATED CHANGE

        MODIFICATION INDICES FOR LAMBDA Y

             ETA 1       ETA 2       ETA 3       ETA 4       ETA 5       ETA
6
           --------    --------    --------    --------    --------
--------
     AGE      .000        .081        .000        .682        .410
.731
PRESTIGE      .005        .000       2.571        .000        .006
1.523
EDUCATIO      .000        .081        .000        .682        .013
.148
COMORBID      .005        .000       2.571        .000        .665
.793
    MMSE      .135        .391       1.198        .603        .000
.113
PRESOCIA      .685        .329        .063        .062        .000
.000
PREHEALT      .005        .000       2.571        .000        .000
2.989
PRESCORE      .139        .385        .408        .043        .000
.074
POSTSOCI      .072        .009        .022        .528        .000
1.646
POSTHEAL      .005        .000       2.571        .000        .000
2.989
POSTSCOR      .146        .385        .514        .043        .000
.039

        MODIFICATION INDICES FOR LAMBDA Y

             ETA 7       ETA 8       ETA 9      ETA 10      ETA 11      ETA
12
```

```
            ________   ________   ________   ________   ________
________
     AGE       .879      1.000       .151       .283       .137
.240
PRESTIGE      1.279       .175      1.498       .925      3.929
1.276
EDUCATIO       .232       .173      4.001       .524      5.168
3.909
COMORBID       .616       .985       .644       .501       .972
.850
    MMSE       .060       .108       .189       .095       .147
.030
PRESOCIA      3.477       .828       .204      4.072      3.693
1.015
PREHEALT       .000       .000       .001      2.970       .363
.001
PRESCORE       .093       .000       .488       .272       .551
.488
POSTSOCI      4.815      1.464       .032       .000      5.627
1.850
POSTHEAL       .000       .000       .000       .000       .000
.000
POSTSCOR       .093       .000       .000       .000       .017
.000

        ESTIMATED CHANGE FOR LAMBDA Y

               ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
            ________   ________   ________   ________   ________
________
     AGE       .000       .401       .000      3.463      -.442      -
.607
PRESTIGE       .059       .000      8.073       .000       .001
.613
EDUCATIO       .000       .070       .000       .603      -.002      -
.054
COMORBID      -.011       .000     -1.562       .000      -.005      -
.143
    MMSE       .203      -.311      3.622     -1.176       .000
1.873
PRESOCIA      -.007       .007       .012       .010       .000
.000
PREHEALT      -.005       .000      -.632       .000       .000     -
1.102
PRESCORE       .187      -.522      1.923      -.559       .000     -
1.420
POSTSOCI       .002       .001      -.008      -.032       .000
.914
POSTHEAL       .001       .000       .124       .000       .000
.217
POSTSCOR      -.111       .298     -1.251       .320       .000
.600
```

```
         ESTIMATED CHANGE FOR LAMBDA Y

               ETA 7      ETA 8      ETA 9      ETA 10     ETA 11     ETA
12
             --------   --------   --------   --------   --------
--------
     AGE       2.310      -.308       .013      -.337       .262      -
.016
PRESTIGE      -1.955       .028      -.025       .432     -1.663
.019
EDUCATIO        .233      -.018       .013      -.092       .327      -
.013
COMORBID        .439      -.021       .005      -.101       .297      -
.005
    MMSE      -1.053      -.242      -.228     -2.394     -3.326
.079
PRESOCIA        .182      -.004       .001      -.833       .129      -
.003
PREHEALT        .000       .000       .000      -.193       .105
.000
PRESCORE      -1.438       .000      -.152      1.265     -3.779
.152
POSTSOCI       -.158       .004       .001       .000      -.278
.006
POSTHEAL        .000       .000       .000       .000       .000
.000
POSTSCOR        .823       .000       .000       .000      1.319
.000

         MODIFICATION INDICES FOR BETA

               ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
             --------   --------   --------   --------   --------
--------
   ETA 1        .000       .000       .000       .000       .410
.731
   ETA 2        .000       .000       .000       .000       .006
1.275
   ETA 3        .000       .000       .000       .000       .013
.142
   ETA 4        .000       .000       .000       .000       .665
.514
   ETA 5        .000       .081       .000       .682       .000
.392
   ETA 6        .755       .712       .000       .052       .000
.000
   ETA 7        .000       .000       .000       .000       .000
.000
   ETA 8        .000       .000       .000       .000       .000
.000
   ETA 9        .005       .000      2.571       .000       .000
2.989
```

```
  ETA 10       .048       .028       .158       .502       .000
.000
  ETA 11       .005       .000      2.571       .000       .000
2.989
  ETA 12       .191       .385      2.386       .043       .000
.523

        MODIFICATION INDICES FOR BETA

             ETA 7      ETA 8      ETA 9     ETA 10     ETA 11       ETA
12
          --------   --------   --------   --------   --------
--------
   ETA 1       .734       .860       .199       .126       .124
.295
   ETA 2      1.279       .175      1.524      1.567      4.635
1.294
   ETA 3       .145       .116      3.947       .544      5.155
3.805
   ETA 4       .616       .985       .741      1.580      1.772
.941
   ETA 5       .740       .851      1.297       .223      2.772
2.808
   ETA 6       .039       .670       .694       .000      2.345
.309
   ETA 7       .000       .000       .001      2.970       .363
.001
   ETA 8       .000       .000      1.471      1.575      3.175
1.471
   ETA 9       .000       .000       .000       .000       .000
.000
  ETA 10      4.739      1.464       .032       .000      5.642
1.850
  ETA 11       .000       .000       .000       .000       .000
.000
  ETA 12       .093       .000       .000       .000       .017
.000

        ESTIMATED CHANGE FOR BETA

             ETA 1      ETA 2      ETA 3      ETA 4      ETA 5       ETA
6
          --------   --------   --------   --------   --------
--------
   ETA 1       .000       .000       .000       .000      -.442        -
.614
   ETA 2       .000       .000       .000       .000       .001
.561
   ETA 3       .000       .000       .000       .000      -.002        -
.054
   ETA 4       .000       .000       .000       .000      -.005        -
.115
   ETA 5       .000      -.159       .000     -1.375       .000
9.874
```

```
   ETA 6      -.009       .014       .001      -.012       .000
.000
   ETA 7       .000       .000       .000       .000       .000
.000
   ETA 8       .000       .000       .000       .000       .000
.000
   ETA 9       .069       .000      9.389       .000       .000
16.389
  ETA 10       .002       .002      -.021      -.032       .000
.000
  ETA 11       .001       .000       .124       .000       .000
.217
  ETA 12      -.133       .298     -2.807       .320       .000      -
2.299

        ESTIMATED CHANGE FOR BETA

               ETA 7      ETA 8      ETA 9     ETA 10     ETA 11     ETA
12
            --------   --------   --------   --------   --------
--------
   ETA 1      2.153      -.294       .016      -.233       .278      -
.019
   ETA 2     -1.955       .028      -.025       .564     -1.848
.019
   ETA 3       .189      -.015       .014      -.095       .336      -
.013
   ETA 4       .439      -.021       .006      -.183       .418      -
.005
   ETA 5     -7.472      1.041      -.849      6.796    -19.278
1.198
   ETA 6      -.043       .013       .004       .000       .169      -
.003
   ETA 7       .000       .000       .000      -.193       .105
.000
   ETA 8       .000       .000      -.446      3.208    -15.860
.446
   ETA 9       .000       .000       .000       .000       .000
.000
  ETA 10      -.157       .004       .001       .000      -.279
.006
  ETA 11       .000       .000       .000       .000       .000
.000
  ETA 12       .823       .000       .000       .000      1.319
.000

        MODIFICATION INDICES FOR PSI

               ETA 1      ETA 2      ETA 3      ETA 4      ETA 5      ETA
6
            --------   --------   --------   --------   --------
--------
   ETA 1       .000
   ETA 2       .000       .000
   ETA 3       .000       .000       .000
   ETA 4       .000       .000       .000       .000
   ETA 5       .000       .006       .013       .665       .000
   ETA 6       .730      1.274       .142       .507       .392
.000
   ETA 7       .000       .000       .000       .000       .000
.000
   ETA 8       .000       .000       .000       .000       .000
.000
   ETA 9       .000      2.563      2.571      2.503       .000
2.989
  ETA 10       .044       .514       .409       .928       .013
.000
  ETA 11       .004      2.563      2.571      2.503      1.230
2.989
  ETA 12       .164      1.585      3.651       .133       .000
.523

        MODIFICATION INDICES FOR PSI

              ETA 7      ETA 8      ETA 9     ETA 10     ETA 11        ETA
12
           --------   --------   --------   --------   --------
--------
   ETA 7       .000
   ETA 8       .000       .000
   ETA 9       .521       .000       .000
  ETA 10      2.970      1.575      2.989       .000
  ETA 11       .521      1.625       .000      2.989       .000
  ETA 12       .070       .000       .000       .523       .000
.000

        ESTIMATED CHANGE FOR PSI

              ETA 1      ETA 2      ETA 3      ETA 4      ETA 5        ETA
6
           --------   --------   --------   --------   --------
--------
   ETA 1       .000
   ETA 2       .000       .000
   ETA 3       .000       .000       .000
   ETA 4       .000       .000       .000       .000
   ETA 5       .000       .809      -.974     -2.687       .000
   ETA 6      -.388       .354      -.034      -.072      6.240
.000
   ETA 7       .000       .000       .000       .000       .000
.000
   ETA 8       .000       .000       .000       .000       .000
.000
   ETA 9       .000   -123.536     12.654     86.485       .000
10.358
  ETA 10       .084       .197      -.050      -.085      1.013
.000
```

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  ETA 11        .035     -1.635        .167       1.145    -13.419
.137
  ETA 12      -5.590     11.806      -5.115      -1.115       .000      -
1.453

        ESTIMATED CHANGE FOR PSI

               ETA 7      ETA 8       ETA 9      ETA 10     ETA 11      ETA
12
             ________   ________   ________   ________   ________

________
   ETA 7        .000
   ETA 8        .000       .000
   ETA 9       9.601       .000        .000
  ETA 10       -.093      1.540     -11.830        .000
  ETA 11        .127     -9.408        .000       -.157       .000
  ETA 12        .489       .000        .000       1.659       .000
.000

        MODIFICATION INDICES FOR THETA EPS

                 AGE   PRESTIGE    EDUCATIO    COMORBID       MMSE
PRESOCIA
             ________   ________   ________   ________   ________

________
     AGE        .000
PRESTIGE        .000      1.767
EDUCATIO        .045       .676        .013
COMORBID        .171      1.399        .419        .450
    MMSE        .062       .335       1.588        .247       .000
PRESOCIA        .431       .678        .005        .385       .206
4.072
PREHEALT        .010      3.239       2.508       2.321       .000
1.220
PRESCORE        .057      1.042        .855        .143       .000
.390
POSTSOCI        .000       .010        .098        .008       .255
.847
POSTHEAL        .010      1.767       2.508        .450       .000
2.963
POSTSCOR        .061      1.041       1.029        .119       .000
.068

        MODIFICATION INDICES FOR THETA EPS

            PREHEALT   PRESCORE    POSTSOCI    POSTHEAL   POSTSCOR
            ________   ________   ________   ________   ________
PREHEALT        .521
PRESCORE        .132       .000
POSTSOCI       2.302       .300       1.646
POSTHEAL        .521       .229       2.989        .000
POSTSCOR        .178       .000        .039        .000       .000

        ESTIMATED CHANGE FOR THETA EPS
```

```
                AGE   PRESTIGE   EDUCATIO   COMORBID       MMSE
PRESOCIA
           ________   ________   ________   ________   ________
________
     AGE       .000
PRESTIGE       .000    -82.185
EDUCATIO      4.861      3.038       .427
COMORBID      2.071     10.874      -.619     -4.960
    MMSE      5.836     -5.352      5.335     -1.475       .000
PRESOCIA      -.232       .206       .005      -.050       .949
.601
PREHEALT      -.254      9.585      -.817     -4.216       .035
.086
PRESCORE      5.028    -16.533      3.962      1.952       .000      -
.845
POSTSOCI       .004       .027      -.024      -.008     -1.463      -
.149
POSTHEAL       .050     -1.265       .161       .395       .000
.083
POSTSCOR     -3.032      9.445     -2.527     -1.016       .000
.308

        ESTIMATED CHANGE FOR THETA EPS

           PREHEALT   PRESCORE   POSTSOCI   POSTHEAL   POSTSCOR
           ________   ________   ________   ________   ________
PREHEALT      -.646
PRESCORE     -1.132       .000
POSTSOCI      -.081       .614      -.660
POSTHEAL       .127     -2.312      -.157       .000
POSTSCOR       .775       .000      -.433       .000       .000

       MAXIMUM MODIFICATION INDEX IS    5.64 FOR ELEMENT (10,11) OF BETA

         THE PROBLEM USED    31360 BYTES (=  6.0% OF AVAILABLE
WORKSPACE)

                          TIME USED :     1.2 SECONDS
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